PUBLIC HEALTH

PAPERS AND REPORTS

VOLUME X

PRESENTED AT THE TWELFTH ANNUAL MEETING OF THE

American Public Health Association

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1884

WITH AN ABSTRACT OF THE RECORD OF PROCEEDINGS

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NOTE BY THE SECRETARY.

The volume herewith presented is the largest that has been published since 1876, and the largest ever published embracing the work of the association for a single year. Its somewhat tardy appearance is due to the fact that with but one or two exceptions, and these were instances where it was not practicable, all papers have been sent to the author to be proof-read, and consequently the work of printing has been many times considerably delayed for the return of proof.

While some errors may and probably will be found, it is believed that no volume in the whole series has received more careful and critical attention than this, which fact, it is hoped, will more than satisfy those who have written the secretary to know why it was not issued earlier in the year.

The secretary has commenced the work of thoroughly indexing the first ten volumes of the reports and papers of this association, as authorized by the Executive Committee. This work will consume considerable time. The index, when completed, will be published in a separate volume, and will be furnished to all who have or may purchase a complete set of the publications of this association. The work will greatly increase the value of the volumes already published; and all subsequent volumes will be thoroughly indexed when published.

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THE SANITARY RESPONSIBILITIES OF THE CITIZEN.

An Address Delivered at the Opening of the Twelfth Annual Session of The American Public Health Association, at St. Louis, Missouri, October 14, 1884.

By ALBERT L. GIHON, A. M., M. D.,

MEDICAL DIRECTOR U. S. N., PRESIDENT OF THE ASSOCIATION.

The child being father to the man, it is natural there should be many of childhood's traits manifested by its banged and whiskered offspring. As the ordinary juvenile regards his teacher as the arch-enemy of his independence and comfort and pleasure, his adult descendant likewise instinctively rebels when he is told what he must and what he must not do. With the invalid's chuckle of satisfaction, when he throws the physician's potion out the window as soon as his back is turned, both he and she (for herein there is no inequality in sex) defiantly determine to do the one, and not the other.

Conscious, therefore, of the doubtful welcome awaiting any one who performs such ungracious offices, I somewhat diffidently assume the task of introducing the body of sanitary teachers I have the honor to represent to a community to whom they are as yet strangers.

It is not difficult to fancy, in the mind of each fair woman, rebellion predetermined, should we venture to assail the established customs of that privileged sex, which delights, so one of themselves asserts, to throw three things away,—their time, their money, and their health,—whilst he who loves the good things of this life, however unwisely, is perchance too wedded to his idols to shatter them at our mere bidding.

To make the prospective dose still more unpalatable, it is offered to you to-night in the form of a presidential address; but this association would not deserve its prænomen of American if it omitted this solemnity. From the stamp-collecting societies of little ten-year youngsters who elect their presidents every four weeks, to that great society which constitutes our nation and elects its presiding officer for four years, inexorable custom tempers the exultation which fills the male or female breast at being invested with the dignity of being set over, if only the two or three who are gathered together, by requiring him or her to deliver a presidential address. Let it somewhat reconcile you to the infliction that yours is after all the better part. You can close eyes and ears, and dream yourselves somewhere else; but the unlucky victim of his own

distinction must run the gauntlet of the eyes and ears that will not mercifully close.

With a full appreciation, therefore, of your plight, as of my own, I promise at the outset not to detain you long; and, lest brevity alone be not enough to entitle me to your forbearant attention, I promise further, remembering your just finished repast, not to drag you unwillingly over the rugged road of any scientific highway, but to stroll carelessly a short half hour among its pleasanter by-ways.

In fact, my predecessors in this chair have left me little else to do than endeavor to convince you that the care of health is as attractive and pleasurable an occupation as can engage a human being. They have recorded the history of the association, and have explained its scope and aims. They have told of the good it seeks to accomplish, and have portrayed the good it has accomplished. What they have said, and others of the members of the association, you will find published in that beautiful series of volumes, which, from their inception, by happy forethought, have been made as delectable to the eye as I am confident you will find them entertaining and instructive. I venture little in boasting that in these four thousand pages, the contributions of men who have identified themselves with the various phases of the sanitary movement in this country, there is not much that is tedious or forbidding.

For ourselves, the retrospect of our transactions is not unalloyed with sadness. Names that were once read on so many pages, in volume after volume, are seen no more. Those who greeted us gladly yesterday are not with us to-day. The past year has made sad havoc in our ranks. Five members of the Advisory Council are among the dead;—Elisha Harris of New York, secretary of its state board of health, a founder of the association, and one of my esteemed predecessors in this chair, whose ambition sought no prouder surname than sanitarian; Charles W. Chamberlain of Hartford, the indefatigable, zealous secretary of the state board of health of Connecticut; Robert J. Farquharson of Des Moines, formerly an officer of the medical corps of the navy, and since secretary of the state board of health of Iowa; John Taylor Gilman, M. D., of Portland, Maine, who became a member of the association in 1873; and Dr. Hillary Ryan of Texas, who did not allow the feebleness of age, nor the infirmity which killed him at a patient's side, to deter him from the wearisome journeys from his distant home to our places of meeting. Fallen with them on the field of duty are Brigadier-General John M. Cuyler, an eminent officer of the medical corps of the United States army, and Professor Willard Parker of New York, who have belonged to the association since 1873; Professor Samuel D. Gross of Philadelphia and Dr. Frederick D. Lenté of New York, who joined it only a year later; Dr. Warren Stone of New Orleans, a member since 1880; and two of the very latest of our recruits, John J. Holbrook, C. E., of New Hampshire, and William F. Sheehan, M. D., health officer of the city of Rochester, New York. Inexpressibly sad were the circumstances attending the death of the latter. On the 22d of July he had

written to me, in his accustomed happy vein, discussing the business of this session, and jocosely questioning wherein he might participate. The same envelope contained a note from his friend, Dr. Herriman, advising me of his death soon after his letter had been penned, and before it could be posted. This last work of his hands will be cherished by his wife among the dearest souvenirs of her deceased husband. With us remains the mournfully tender reminiscence that the last thought and act of his promising career were of what he might do for this association. Young, hale, and vigorous, intelligent, prosperous, and happy, dead with the joy of life in his heart,—what sadder episode than this! One other name must be added to the list of the year's honorable dead, that of Lieutenant-Colonel Joseph Janvier Woodward, surgeon U. S. A., one of the original and most earnest members of this association until the darkness that enshrouded his mental powers shut out from him the living issues of the world in which he had borne so active and so meritorious a part. The good these men have done will live after them, and the star before their names upon our list of members symbolizes their translation to that firmament of departed intelligence whence "to give light upon the earth" to those who linger upon it.

All I will attempt this evening will be to convince you that the sanitarian is not a grim-visaged, self-denying, self-tormenting ascetic. If you have come presupposing that the priesthood of Hygeia find pleasure in mortifying the flesh, and making of this fair, natural earth a repulsive artificial purgatory, begin at once to undeceive yourselves. The votaries of health eat, drink, and are merry, singing the pæans of Apollo, but bearing in mind the Nautch girl's admonition to tune the sitar neither high nor low:

> The string o'erstretched breaks, and the music flies,
> The string o'erslack is dumb, and music dies.

From its birth this association has carefully avoided committing itself to the endorsement of fanatical extremists, who, with however commendable purpose, annul the good less radical measures accomplish. The zealous colporteur, who floods the schools with stories of good little boys and girls who never soiled their clothes, and never snapped and snarled at each other like their brother brutes, ends only by developing an admiration for the boy who dared be wicked and enjoy himself. The sick man on the hospital cot, craving some mirth-exciting antidote to pain, turns wearily away from Baxter's Saints' Rest, or homilies on the seven cardinal virtues and anathemas upon the seven cardinal sins. Even the Bible, however gaudily labelled and conspicuously placed by every seat in the railway car, remains untouched if a newsboy offers *Puck*.

The American Public Health Association denounces intemperance in any form, and counsels temperance in all things. It shows how crime is begotten by sin, and sin begotten by disease, and disease begotten by filth, and filth begotten by ignorance; but it does not seek to dispel

ignorance, and remove filth, and overcome sin, and punish crime by manacling the thinking man with irons, and binding him with thongs that cut into the flesh, and weight him down from freedom to act. It infringes upon none of his inalienable rights to do with himself what he will, save when his selfish doings in any way affect or concern his neighbors and his offspring. He can dose himself with nostrums, until, as Dr. Farquharson stated in the British house of commons, quoting from the registrar-general's report for 1881, twenty had died from chloral hydrate, eight from chlorodyne, five from Godfrey's cordial and soothing syrups, and fifty-one from other patent medicines; and if the remains are decently interred, or, better, cremated, no doctor among us would thwart his effort to rid the world of one more fool. If it have been your idea that the members of this association have come to preach a holy war against all the indulgences of life, you need have them with you not many days to be undeceived. Let me begin at once to undeceive you.

The public health—the health of the community—is only the health of its individual members, and health is only that condition of well-being, well-feeling, and well-doing of each man, woman, and child, which enables him and her and it to enjoy pleasure and communicate it to others—to be happy and to make others happy. It is our self-appointed office to point out the way that leads to this Castle of Delight; our self-imposed duty to see that ignorance, indifference, and inaction do not hinder those who aim to reach this goal.

The sanitarian is the natural guardian and mentor of this mortal body from the moment when two animated, wandering, microscopic molecules meet and mingle into that one other which is to grow into what you and I are, until fifty, sixty, perhaps a hundred years after, its elements are given back to the cosmic storehouse whence they had been borrowed. With that other attribute of man, which defies death and the grave, he has no concern; nor does he magnify his proper charge by deriding the metaphysics of the theologian, nor the latter make men more mindful of their souls by disparaging their bodies. Each of these two great classes of the teachers of humanity has hindered the other, the latter perhaps the more, since the neglect of the body has been the foundation of all the suffering and sorrow of this mundane existence.

And why should this human body be contemned? Is it not the most wonderful mechanism of which the human mind can form conception? Is not its development from a single wriggling monad into the Divine paragon so marvellous that his own intellect cannot conceive its how? Is not the rosy, chubby, gleeful child, the thewed and sinewed man, or, best of all, she with curves of beauty where he has points of strength, the lovely vision whom art vainly essays to portray,—are not these the most beautiful of all the beautiful sights this world offers or the imagination conjures?

If we have minds that enable us to know ourselves, intellects to reason why we are, sensations to perceive our environment, emotions to link us to our fellow-beings, is it not only because within this corporeal form

there is a mass of cells, a structure sound in all its parts, nourished by pure blood, formed from good food and drink and air? Close, one by one, these windows of the soul, out of which it looks upon this world, or in upon itself, obliterate vision and hearing and touch and taste and smell, be the tenant within never so great or grand, he is buried in a tomb that has no exit.

A thing so beautiful, so marvellous, so wonderful, that man cannot even imitate its inanimate outlines,—this organ of his intellect,—ought to command our profoundest admiration and ever zealous care. Fashioned in the image of the Creator, made but a little lower than the angels, why should we neglect this thing of flesh and blood and bone and sinew till its beautiful outlines are marred, its parts jangled and out of tune, its vigor wasted, and, prematurely worn, it is only fit for the decay which has been invited? Were there no other motive, that strongest of all human incentives, self-interest, should induce us to care night and day, with earnest, watchful thought, for this living, moving, feeling, thinking body. I am what I am; and if I am to aspire to excellence, to attain the highest possible development, to feel and do and become all that man may be, I can only do it by cultivating, developing, improving, and beautifying this thing, which is myself: and this brings me to the a-b-c of all sanitary science—that science whose advancement is the prime object of this association. The first step towards the improvement of the public health is the physical purification of the individual. Teach him to care for his own bodily welfare in childhood, in youth, in adult life. The one foul centre soils in a hundred tangents. Only healthy parents can engender healthy offspring: only healthy children can grow to healthy men and women by being properly fed and clothed and nurtured, and these can only remain such by keeping at bay the warring enemy of disease. The bravery of the army is but the bravery of each soldier; the sound sanitary condition of the community only the sum of the cleanliness and vigor and salubrity of each of its constituent members.

These are such simple and self-evident truths that it seems idle to present them, yet these are the only problems we have to propound. There is no mystery, no mysticism in our philosophy. The topics we have selected for our annual programme mean only this: The hygiene of the household and of the school, of the householder and his children; how to secure wholesome food and pure water; in what way to remove the waste that becomes filth and breeds disease. This is all there is of it.

Fellow-citizens of St. Louis, this association comes here in the hope of awakening in you that interest in your own welfare which you have no right to disregard, if not for your own sakes at least for the sakes of your children, and for the sake of the community of which you are a part. Scarcely one of you but has suffered some sad bereavement. Do you realize that quite half the deaths which are happening around and among you need not have happened; that these neighbors and relatives have died from diseases due to preventable causes—diseases which this

and kindred associations, state and municipal boards of health, are aiming to make no longer possible? In Russia, where sanitary neglect is proverbial, the average duration of life is only twenty-six years, over sixty in every one hundred children dying before they are five years old. Even in the United States almost half the dead—forty per centum—are children, who have not passed their fifth year of age. The total mortality, reported in the census of 1880, was 756,893, among which were 8,772 deaths from measles, 16,416 from scarlet fever, 22,905 from enteric fever, 65,565 from diarrhœal diseases,—all preventable, but these not all the preventable maladies.

Knowing this, do you think, each and every one of you, that you have done your duty, your whole duty to yourselves and your children and your neighbor, in preventing as much as possible these untimely deaths?

First: Do you live in a house that is properly drained of its seepage? Do you know this to be so of your own knowledge? Have you taken the trouble to see with your own eyes, or with the eyes of some competent and responsible inspector, that the joints are hermetically sealed, that the earthen soil-pipes are not deflected and cracked or perforated by rootlets, that the outlets are securely trapped, the sewers unobstructed, flushed clean, and ventilated? Is there a pool of fecal matter under your cemented cellar floor? Does the polluted sewer-air, shut off perhaps from your bed-rooms, find its way through some neglected or unthought-of kitchen sink, or some plumber's ingenious labor-saving over-flow, and permeate every part of your beautiful home? If you have not this assurance, and your wife or your child dies from typhoid, from diphtheria, from scarlet fever, then let your conscience say to you as Nathan said unto David, "Thou art the man. The evil that has arisen against thee in thine own house be on thine own head." Do not, like a wealthy friend of mine whom I met at a summer resort, where he was seeking to recuperate the health of his wife and himself from a sickness they had shared with the child who died, sit down and wring your hands and bemoan your lot, when, as in his case, a windowless, unventilated closet, most convenient to the luxurious chambers of his Philadelphia palace, had made it a viler habitation than the peasant's well creviced hovel, or the frontiersman's open-sided log cabin.

Again: Thou merchant, thou banker, thou learned judge and reverend divine, and thou, too, O sapient doctor of St. Louis,—is this milk real milk your children are drinking? this sugar only sugar they are eating? Is it butter, honest butter of the churn and not of the laboratory, they are spreading upon their bread? and is that bread of flour, or of chalk and alum and starch, and what not else? Are your bakers and butchers and dairymen all honorable men, whom it is supererogatory to suspect, and whom you therefore never question, neither yourself nor the well paid, intelligent, skilful inspectors whom you have employed to do this questioning, and to see that no tainted and diseased meat, no immature and decayed vegetables, no pernicious or adulterated groceries, are offered for sale, nor even brought within the limits of your fair city?

But bread and meat, fruit and vegetables, food and drink, may all be good and wholesome, and still, by your culpable, criminal carelessness, you may deliberately admit into your bodies an impurity that is fouler than all others. Since the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life, and man became a living soul, that breath of life has been to him the one essential of his being. He can wallow in filth—I will not say like swine, for properly conducted swine do not. He can feed upon offal, go naked and hungry and wild, drink from slimy pools, and sleep on a bed of rock or make his lair in reeking jungles, and yet live;—but deprive him of air, he dies; poison that air, he becomes diseased. Bountiful nature supplies him without cost of labor or thought with this great need of existence. A boundless ocean surrounds and permeates him. Foul it—it purifies itself. Only when the devilish ingenuity of man thwarts nature's efforts—cribs, cabins, and confines it—does it retain the poison he has added.

Citizen of St. Louis, are you one of this devil's handiworkers? Do you immure yourself and your children in houses where foul air has no exit, and pure air no ready entrance? Do you do all you can, besides breathing into it and adding to it the effete exhalations of your bodies, to befoul it by sewer and coal and illuminating gas and hot-air furnaces? Do you congregate in churches to hear the word that is to save your souls, and implant in your lungs the seeds of malign growth that will destroy your bodies? Do you go to theatres to be made merry, and come away with cause for tears? Are you sure that here to-night the air around us is not full of abominations that only need be made visible to cause you to rush pell-mell out-doors?

Are you weary with my catechising? One question more: Do you go to school with your child? Do you ever ponder why it does not eat, why its face is wan, its shoulders rounded, its form bent, its gate tottering, its sight bleared? why it is petulant, and peevish, and perverse? why it talks and walks in its sleep, sees ghosts, or does not sleep at all? Have you ever worn the magic stone of Mr. Bultitude, and put your intelligence in the childish form, and breathed the vitiated school-room atmosphere it breathes, sat on the racking benches, in the blinding glare, sniffed the latrines that even the dogs shun, and then with glad, grateful hearts boasted how much grander are the education and civilization of the nineteenth century then when unkempt teachers taught in the open air under the shade of green trees?

I have not, however, come here to arraign you as especially guilty of high sanitary crimes and misdemeanors. All, and more that I have hinted to you, of the things you have done which you ought not to have done, and especially of those you have left undone which should have been done with all your heart and mind and spirit, may be charged against that staid city of culture, where the cradle of American medicine was rocked by Quaker matrons. In the very heart of that city, rather, in its head, under the shadow of the Temple of Liberty, where the brightest minds among its fathers and sons daily win forensic laurels,

one has to pick one's way through reeking pools of fetid ooze, concealing the cobble-stones, until partially swept into stinking masses by decrepit laborers with unwieldy brooms,—little heaps of filth that lay till they roll back to a level, or are carried into the sewers to fester underground, and generate the sickening odor that arises from every street inlet. It is the fashion to ridicule the unprogressive Spaniard, who, at the gates of Madrid, ploughs the field with a crooked stick, as his ancestors did centuries ago; yet here intelligent men daily witness this farce of street cleaning, this tragedy of street pollution, at their very doors, and hold their peace, each hoping to escape, yet escaping only as he who has trodden blindfold over red-hot ploughshares.

What shall we do to be saved—we who live in cities? The means are simple,—*Organize*. Individual effort may accomplish little, very little, but the concerted, systematic efforts of intelligent men and women can change the face of nature; and this is the *second* of the objects of our association,—"The promotion of organizations and measures for the practical application of public hygiene." For this we have come to St. Louis: with this intent I address you to-night.

We have no especial form of organization to suggest to you, no pet theories to advocate, no particular scheme to recommend. There are many roads to Rome. Choose the one you will, only all travel together. In time the shortest and safest will commend itself. A little more than fifteen years ago a state board of health was organized in Massachusetts. Not long after, California modelled one upon it, and next Minnesota; and it is significant to note that since that time the Western states have been far in advance in the matter of sanitary reform. The state boards of health have there attained their widest usefulness. With various details of internal organization, state boards have been created in every state of the Union except Maine and Vermont, Pennsylvania and Ohio, Florida and Texas, Kansas, Nebraska, and Nevada. Had this meeting been held a year ago, I should have been compelled to include Missouri. A year hence Texas certainly, and perhaps Ohio, will cease to be exceptions.

It does not matter on what plan these boards are modelled, nor what the creed, or party, or profession of their members. Only let them be men of skill and reputation, of fearless independence and unquestionable probity, and, since seven or nine is the usual number of members, a community must be worse than the Cities of the Plain if it can not produce that many, and, having found them, keep them until, like Rauch in Illinois, and Baker in Michigan, and Reeves in West Virginia, and Hewitt in Minnesota, and Chancellor in Maryland, and Thornton in Tennessee, and in this connection I might call the roll of the association,—until, I say, state, cause, and man shall have become inseparable terms.

To be successful, such a board must be untrammelled, well-sustained, and liberally provided. If you would have the first spark of epidemic disease discovered and stamped out—and Illinois and Tennessee and

Minnesota have proven how easily this may be done—you must not higgle over the few hundred or many thousand dollars required for the enginery which is to isolate and exterminate, but regard it as an insurance against worse accidents than fire and flood—an assurance that you can go about without fearing to meet the pestilence that walketh by night. Had intelligent quarantine precautions been rigidly enforced, which would have protected New Orleans from the yellow-fever epidemic of 1878, there might have been lost, said Choppin to me, a million and a half dollars in trade: their omission entailed a needless waste of eleven and a half millions. Dr. Benjamin Lee, now president of the American Academy of Medicine, in a paper presented to this association at Baltimore, November 11, 1875, demonstrated that the small-pox epidemic of Philadelphia in 1870–'72, during which there 20,065 cases and 4,464 deaths, inflicted a loss upon the community of over $21,000,000. As eighty-five of every hundred of these 20,000 cases, and 95 per centum of these deaths, representing 4,240 sacrificed lives, were preventable, he thus sums up the account: "An additional expenditure by the city authorities of about $20,000 for purposes of prevention, made sufficiently in advance, and with such publicity as to make the public fully aware of the impending danger, accompanied by appropriate sanitary legislation and hearty coöperation on the part of its inhabitants, would have resulted in a saving to the city of Philadelphia the sum of $24,720,718." And this coöperation is most important, for, as Richardson well says, "No progress can be made in preventive medicine without a sympathy of action based on knowledge, to enable every man and woman to assist." Dr. John H. Rauch, our former president, in his fifth annual report as secretary of the state board of health of Illinois, after stating that "small-pox invaded seventy-seven of the one hundred and two counties of the state during its epidemic prevalence [1880–'82], causing an aggregate of 8,856 cases and 2,978 deaths, and involving a cost of nearly $4,500,000, exclusive of the value of human life lost, and the disabled condition of many of the survivors," adds, "within twenty days after the various agencies set in operation by the board had fairly begun to act, there was a decline of nearly 50 per cent. in the number of cases, implying a constructive saving of 320 lives and 1,157 cases, and $2,250,000." The consul-general of the United States at Rome telegraphed to the state department, September 16th, with reference to the cholera epidemic prevailing in Italy: "In consequence of the quarantine, commercial intercourse with foreign countries is nearly suspended, while Sicily and Sardinia are cut off from the other parts of the kingdom. Beside the great loss to foreign commerce, it is estimated that about 400,000 persons will be prevented from visiting the country this season." Assuming these persons would have spent an average of only $50 apiece, this one item of loss amounts to $20,000,000. According to Sir James Paget, in his recent address on "The National Value of Public Health," there is lost in England and Wales every year in consequence of sickness twenty million weeks' work,—that is, as much work as twenty million healthy

people would have done in one week,—which is one fortieth part of the entire work done in each year by the whole population between fifteen and sixty-five years old." Sanitarians themselves would do well to bear in mind these giant figures of loss, and be not so ready to accept without protest the niggardly appropriations doled out to them. To be effective, sanitary work must be thorough, and to be thorough means for it must be generously supplied. Paper edicts, and a public parade of opened fire-plugs and odorous disinfecting apparatus, will not keep cholera away. It is the unobserved house-to-house work of the competent sanitary inspector, who delves into every cellar, peers into every closet, rummages in every alley, which makes the advent of such a plague impossible: and this costs money, much money.

There is scarcely a limit to the good that a well-supported board, possessing the confidence of the people, may not accomplish. Not content, merely, with removing nuisances, and wiping out pestilential spots of filth, the state board of health of Illinois has undertaken to prevent the occurrence of nuisances and the accumulation of filth by instructing the people as to the personal advantages and social obligations of cleanliness. Thousands of tracts have been circulated in the several languages spoken by the laboring classes of the state on the subjects of some of the more dangerous of the preventable diseases. If made intelligible and attractive, the humblest members of the community may, in this way, in time be reached and educated; and by means of authorized bulletins, and editorial notices in the public press, sanitary intelligence might become a matter of daily inquiry and observance, as when the national weather forecasts were anxiously scanned to know how one should dress.

The work of the state board would be immeasurably aided by efficient municipal boards; but the baneful shadow of our municipal system has deprived them of that non-partisan, non-sectarian color which the state boards happily possess, and which is essential to their efficiency. The great corporation or the wealthy manufacturer buys his civilian representative on the local board, and the vile refuse of the factory pollutes the waters, its noisome stenches fill the air, living dirt accumulates upon the surface, till as in Philadelphia it envelops the whole city with its slimy mantle, and the patriot pilgrim to the shrine of Independence doubts which is the greater marvel, the spot where a great nation was born, or the pestiferous mud he has waded through to reach it.

When the city authorities are incompetent, indifferent, or venal, the people still have a powerful means of self-protection by organizing auxiliary sanitary associations, as was first done at Edinburgh on the plan proposed by Professor Fleeming Jenkin, and soon after, in November, 1878, at Newport, Rhode Island; in April, 1879, at Lynn, Mass., and at New Orleans; and two years later at Savannah. It is one of the boasts of this association that its meeting at the latter city in 1881 bore such excellent fruit; and it will have equal reason for exultation if at this session it succeeds in awakening among the people of St. Louis a livelier sense of the obligations imposed upon them by their citizenship to con-

sider seriously this matter of the public health, if it can make each householder and father feel that he has no right to be indifferent and inactive, each communicant of a church that his Sabbath prayers and thanksgivings are a hollow sham if he have neglected to do with all his might all in his power to prevent disease, and his professions of sinning only a complacent formality of the ritual and not expressions of his own share of culpable responsibility for the suffering, misery, and evil-doing all around him.

These citizens' sanitary associations need not be antagonistic or substitutive for municipal institutions. In the language of the Sanitary Protective Association of Newport,—" The association will not conflict with the public authorities, but will supplement their action. It simply aims to have every house in the city in a proper sanitary condition,—1, by providing its members at moderate cost with such advice and supervision as shall insure the proper sanitary condition of their own dwellings; 2, by enabling members to procure practical advice, on moderate terms, as to the best means of remedying defects in houses of the poorer class in which they are interested; 3, by aiding or improving the sanitary condition and consequent good repute of the city, by following such course as in the opinion of the council may seem calculated to promote this object."

Now this is precisely what should be done in St. Louis, and without delay. The spectre of pestilence is on your horizon. You have had timely warning of its approach. It will be too late to bar out the grim fiend after his shadow has fallen across your threshold. If your city is scourged, you—you intelligent citizens, and you only—will be to blame. It will not fill the vacant places in your homes to denounce incompetent authorities. Take the matter into your own hands, and begin to clean: it is the Augean task of Hercules. The lair of the beast is amid muck and moisture. Open and let in the light; clean and white-wash every cellar and hovel till there shall be no such thing as that abomination, " cellar air,"—air which causes the saliva to flow when you get a whiff, air laden with all sorts of microscopic pests. Empty every cess-pool, fill up every stagnant puddle, clean out every neglected alley, cul-de-sac, and obscure lot, destroy rubbage, burn rags and moldy straw, and rotten, soggy planks. Where there are fresh air and dryness and cleanliness there can be no cholera; and where these are not, it will come spite of proclamations and perfunctory quarantines. Fumigations and disinfections, which mask putrescence and substitute medicinal smells for sickening stenches, are as ridiculous as the noise of gongs and tom-toms and exploding fire-crackers and jingalls by which the Chinaman hopes to frighten the devils who desolate his home and country, and worse than useless from the false sense of security which they give. Even the exorcism of prayer had better not be attempted kneeling, but upon the feet with both hands hard at work.

I stated at the outset that I would not review the *faits accomplis* by this association in particular, and the selection as one of the topics for

consideration at this session, of "The observable effects of official sanitary supervision," absolves me from the duty of commenting upon them in general terms; but I may be permitted to quote a leaf from my own personal experience that is valuable corroborative evidence of the good that follows efficient sanitary supervision.

Early in the year 1855 I became an officer in the navy of the United States, and I was not long in discovering that a medical officer, in the first place, was not regarded by his live associates as an officer at all, and, in the second, that his functions as the "pill-dispenser" he was assumed to be were sought to be exclusively restricted to the healing of wounds and sores, and the curing of such as might become sick, without his presuming to inquire why they became sick, and how others might be prevented from getting so. Fortunately I had been taught that the science of medicine had a wider outlook than the sick-room, and that the office of the physician was something else than to be the tinker of broken bones and the mender of human mechanisms that human stupidity, human ignorance, and human arrogance had needlessly marred. I had no lack of so-called legitimately professional occupation. I lived among the sick and the dying. In thirty months there were *thirteen hundred and forty-five* cases of sickness in the little community of only two hundred officers and men, the daily sick-list often ranging from thirty-two to thirty-five a day month after month, and among them no suffering women or feeble children, no old people, or lives wrecked by penury or toil, but all of them stalwart, adult men, chosen for their vigor for a career that ought to be exceptionally salubrious. We buried twenty-eight of the two hundred! How many more among those who deserted, or were invalided or discharged from the service, were buried by other hands I know not, but the pension office daily brings to notice such shattered lives that come begging its meagre bounty. While improper diet, insufficient clothing, ill-judged exposure, filth and foul air, and reckless wetting of the decks made men ill, not all the drugs in the dispensary, nor ten times the medical officers' skill, could make or keep them well. Surgeon in title, physician in vocation, I had the lesson taught me that before all I must be a sanitarian; and ever since I have been an ardent one, and to-day I can bear personal testimony to the observable effects of official supervision, as it has been insisted upon in the navy by my colleagues of the medical corps, in spite of opposition that has often amounted to insult and indignity. During the past year, as a member of the board of inspection of the navy, I inspected a vessel which had returned from a three years cruise, part of the time on the unhealthy coast of Africa. Among her complement of two hundred and twenty officers and men there had been during these thirty-six months but a single death from disease, an average daily sick-list of 4.22, including trivialties that were formerly not recorded at all, and only seven men invalided for disabling diseases.

This is the story of only thirty years of sanitary progress: this is an observable effect of sanitary supervision. Dark, damp, dismal, unventilated, fetid decks, crowded with listless, surly, discontented, wretched,

ailing men—vicious as well as sick—on the one hand: on the other, bright, clean, dry, airy, unencumbered decks, with comfortably clad, well-fed men, contented, cheerful, hale, and hearty.

Fortunately I am able not only to establish in this example what official sanitary supervision has done, but very decisively by another, not less striking, the evil that the cessation of official sanitary suspension has brought about; and you, citizens of St. Louis, especially, ought to take this lesson home, since your city was the theatre, a few years ago, of a somewhat similar experiment. There is a certain abominable class of diseases, which are more virulent and destructive in their effects upon the human race than small-pox, cholera, yellow fever, or any other known scourge,—diseases which on well-founded estimates are believed to affect in various degrees of severity not less than two million of the population of this country,—diseases which assail the guiltless wife and innocent child as readily as the debauchee and prostitute, and against which no degree of personal purity and probity are effective safeguards. In England the experiment which you performed, not in the most satisfactory or commendable way perhaps, was inaugurated in 1863, under the title of the Contagious Diseases Acts, chiefly for the benefit of the garrison towns and naval seaports, where large bodies of enlisted soldiers and sailors were aggregated, whose efficiency was seriously impaired by the diseases to which I have reference. The partial application of these acts made comparisons possible between the places where they were in operation and those where they were not; and about two years ago I had the honor of reading a paper before the Medico-Legal Society of New York, in which I presented tables from official reports to parliament by the directors-general of the medical departments of the British army and navy, showing that while from 1860 to 1863, before the enforcement of these acts, the ratio of these diseases was about the same everywhere (in fact, higher in the ports subsequently brought under the influence of the acts, being 70.05 per thousand in the former, and 75 in the latter), by the year 1880, in consequence of the operation of these acts, it had fallen to 40.64 in the ports protected by them, while the proportion had arisen to 95.35 per thousand in those not thus protected;—an experience precisely similar to that of the army stations, the facts there being that while in 1863 at fourteen stations till then unprotected the proportion was 129 per thousand, and in fourteen others 116, in less than twenty years these latter stations which continued unprotected exhibited a ratio of 101, and the protected stations, though formerly in excess, only 44.

Notwithstanding these incontestable results, the persistent efforts of a certain well meaning but narrow-minded set, by sentimental appeals and wily and ingenious misrepresentations addressed to the religious classes, most of whom were totally ignorant of even the existence of such diseases, and especially of the risks from them to which they and their children were subjected, effected the suspension of these acts, on the 12th of May, 1883; and in only seven months this cessation of official sanitary supervision had borne this fruit: The fourteen protected army stations,

which till then had a proportion of 145.73 per thousand cases of disease as against fourteen unprotected stations, which had 259.44, suddenly rose to 258.8,—while the naval results were precisely parallel, the number of sick among 22,000 men having been in 1880 129.4, in 1881 134.9, in 1882 125.1, rose in the seven months of 1883 (May 12 to December 28) to 214.7.[1] The further significant fact was noted, that while the admissions to the certified hospitals were 2,542 in 1880, 2,476 in 1881, 2,254 in 1882, there were but 720 in these seven months of 1883, the number of unrestrained diseased individuals roaming at large being therefore three times as great as when the acts were in force. At the eastern term this year the grand jury of Colchester came into court at quarter-sessions calling attention "to the increased immorality in the town since the modification of the Contagious Diseases Acts has come into force," and the recorder stated that he had information from the mayor of the borough which rendered their presentment no matter of surprise. The cases of disease in the military hospitals having increased threefold, the magistrates of Maidstone have unanimously expressed their opinion that the Contagious Diseases Acts should be reënforced. No patients from Maidstone, Deal, Winchester, or Windsor had been admitted into any of the certified hospitals for the preceding nine months. The government hospital at Shorncliffe has been closed, and only three women from Dover had been admitted into the hospital at Chatham.

The investigation of this subject by this association in former years gives these data, which are extracted from official returns presented to the house of commons on the motion of Sir Drummond Wolff, peculiar and pertinent interest, although the scheme for the protection of the innocent and helpless members of the community against these diseases, advocated by your committee, of which I had the honor of being chairman, had nothing in common with the British Contagious Diseases Acts, nor the St. Louis license experiment, but proposed to legislate broadly and indiscriminately against the men, as well as the women, "who knowingly communicate, or are instrumental in communicating, directly or indirectly, any contagious disease, whether small-pox, scarlet-fever, or venereal disease," and to hold them guilty of a misdemeanor, and punish them accordingly."[2]

But I have promised not to detain you long, nor weary you with dry detail. My proper office is to invite you cordially to attend and assist at our sessions. The topics we have chosen cannot fail to interest,—the adulteration of the food you eat, the pollution of the water you drink as well as the beer, the sanitary improvement of your houses and occupations, the removal of offensive refuse, and especially, and above all, the hygiene of your schools. In view of the magnitude and moment of

[1] The ratios at Haslar (Portsmouth), with a force of about 7,000 men, were for the periods above mentioned 137.5, 190.8, 191.7, and 283.7, respectively; and at Plymouth, with a strength of about 7,500 men, the corresponding ratios were 129.4, 137.1, 104.1, and 230.7.—*The British Medical Journal*, No. 1213, March 29, 1884.

[2] Reports and Papers of the American Public Health Association, vol. VIII, p. 333.

this one subject, perhaps it would have been well for us to have considered it alone. It sounds like rank heresy for me to declare that there is anything vicious in the system of American public school education; for the public school establishment has been considered the jewel in the cap of the Goddess of Liberty, the blue riband on the neck of the bird of freedom. Nevertheless, is it not true that your stately school-houses are crowded beyond every sanitary propriety with hordes of feeble children? Enter them fresh from the outside air, an hour after the session has begun, and you recognize the mawkish odor of human effluvium which these poor children, and the one pale girl condemned to teach, watch, and control perhaps sixty unruly boys, are compelled to breathe until poisoned by it. Are not their undeveloped plastic bodies distorted on uncomfortable seats, at uncomfortable desks, their eyesight progressively deteriorated by glaring windows and poor type, their physiological necessities opposed by inflexible rules and protracted hours? Then, as if mere physical cruelty were not enough, a new torture has lately been devised called *mental arithmetic*, and, with hands convulsively clutched behind their backs or rigidly extended by their sides, to make their sufferings more intense by repressing the muscular actions which would give relief to the nervous tension, the embryo artist and budding musician and mathematical prodigy alike are required to tell how many apples at $2\frac{1}{16}$ cents apiece a man can exchange for onions at $9\frac{2}{13}$ cents a dozen, or how many pairs of slippers a shoemaker who had no money would be required to make at $62\frac{3}{8}$ cents a pair to pay for two barrels of flour at $5\frac{1}{6}$ dollars a barrel,—problems, it is claimed, so simple that any dullard can solve them with slate and pencil, and therefore required to be evolved without this aid in the name of intellectual exercise.[1] This and the baby farm, the infant school, and the compulsory nightwork of the child encouraged or allowed to compete for bogus medals, are unsightly blots upon our records, which every sanitarian should labor to erase.

The progress and welfare of a people are dependent upon the proper rearing of its young;—therefore, I ask your careful attention to the report of the very able committee of this association on school hygiene; and, in this connection, I have one word to say to the association itself. Having so satisfactorily accomplished its novitiate, it can now deliberately consider the most effectual way of fulfilling its objects. The variety of subjects, and number of papers annually offered, have compelled the executive committee to select certain special topics for consideration at each meeting. The suggestion I now make is, that, at the close of the meeting at which these papers are read, special committees shall be appointed, of members who have shown interest in these respective topics, to report their collective experience and conclusions at a subsequent meeting. Thus the deliberate opinion of the association, carefully phrased, will be placed on record, and published to the world in our Transactions. I

[1] Pertinent to this, I desire to call attention to an extract from the report of the superintendent of the Quimby schools (Sylvester Brown), in the recently issued report of the Commissioner of Education for the year 1882'–83, pp. lxxxii, lxxxiii.

look upon this committee work of the association as its most effective means of accomplishing its objects, and fortunately the admirably selected committees of this year themselves furnish the best argument for the course I have suggested.

I do not flatter myself that I have convinced any unbeliever among you that we are preachers of the true faith. I have not sought to do more than induce you to come, and listen to the papers and discussions. Do not come with the idea that we aspire to make this earth elysium. All that live cannot be free from suffering. Among the little ones that come wailing into the world are some who ought never to have been born, and whom it were well if they were early blighted. Neither has hygiene any share in that utopianism which measures every appetite by regulated necessity, bidding us to eat just that weight of just such food, prepared with no culinary estheticism; to drink only water or milk, or the unfermented juices of fruits, or decoctions and infusions of bitter herbs, and eschew wine, beer, and hard cider; even to deny the marital caress to the promptings of emotional impulse, and make it a calm, deliberative, purposive, genesaic act. Nature is wasteful. Germs of all living things are born in needless profusion, and perish unnumbered with the forest leaves and the myriad swarms of the microscopic world. Only the fittest ultimately survive; and it should be our aim not merely to add a span to each poor puny life, but to make the strong stronger, till the evolution of the race into the highest order of which humanity is capable shall have been accomplished. Every human being cannot be made to live three score years and ten. Some are doomed from birth prematurely to die, and we cannot save them; but we can and ought to save those that have a right to live, who are now slaughtered in hetacombs by preventable diseases.

II.

ADDRESS

By His Excellency THOMAS T. CRITTENDEN,

GOVERNOR OF MISSOURI.

Mr. President and Gentlemen: It affords me great pleasure to speak in behalf of the reception committee representing the citizens of this good city in extending to the American Public Health Association a most cordial welcome. Nay, in this I am not circumscribed by the limits of one city, however great. In the name of the people of Missouri, I bid you welcome to our midst.

If I understand the purposes of your association aright, philanthropy never gave to the world a nobler illustration of disinterested kindness and benevolence than those objects exemplify.

A *quasi* medical association—in this, that the chief object to be attained by your labors and investigations is the preservation of the lives and health of the people and the amelioration of their sanitary condition—you are not embarrassed by any fear of violating some technical point in ethics, as prescribed and adhered to by the representatives of some particular school of medicine. For you must know that, to the profane, professional ethics, so called, are as much to be dreaded as the small-pox. Nor in this do I in any wise mean to speak disparagingly of reputable physicians, or of their noble profession, in the prosecution of which so much of patience, arduous toil, charity, intelligence, and devotion is required. I honor such men, but I do rejoice that in the composition of your society a broader and more comprehensive view of the necessities of humanity has formed the basis of membership than may be found in the particular tenets of any particular school of medicine.

Sanitary science is a noble theme, and has commanded the earnest attention of the leading scientists and most enlightened men of our age. It has at last been discovered that it is safer and cheaper, and in every way better, to prevent disease than it is to cure it: and this upon the same principle that it requires a higher degree of skill in surgery to save a badly injured limb than to amputate it. Any cross-roads saw-bones may perform the amputation (and they rarely miss a favorable opportunity), but where is the surgeon whose skill shall restore the man to health, whole and sound in every part?

Your programme contemplates the discussion of such important questions as "The hygiene of the habitations of the poor," "School hygiene," "The disposal of sewage," and such correlative topics as may belong to a thorough investigation and discussion of these grave problems. It were idle for me to insist upon the importance of and the necessity for a

universal recognition of the relation of all these matters to the public health. A large majority of the people in this country are in humble circumstances; many live in absolute poverty; hundreds of thousands of children attend our public schools. During ten months in each year these children are congregated, frequently by the hundreds, in many instances in over-crowded and badly ventilated rooms, and thus the very beneficence of our common-school system (and I thank God that America leads all other countries in the universality and efficiency of her educational facilities) becomes the vehicle of propagating disease. Shall we say that the children, upon whose intelligence the future of our country depends, and God's poor, whom the Saviour of the world said "ye have always with you," are not entitled for their own sakes to our best and most intelligent efforts in caring for their health and comfort? How much more, then, are we interested, when the neglect of these may assist in feeding an epidemic, which attacks all alike.

I conclude, from the nature of the questions to be discussed, and from the scope and direction of your scientific researches, that I may properly sum the whole matter up in the one great, momentous problem, What means shall we adopt, and what rules shall we observe, in order that we may, at least, *deserve* immunity from infectious diseases? If, as is predicted by eminent medical authority, there is danger that the Asiatic cholera may visit our shores next year, the importance of your investigations and conclusions cannot be over-estimated.

"In time of peace prepare for war" applies with telling force in this matter. After the plague shall have fallen upon us it will be too late to look to sanitation for relief. When the sombre shadow of the death angel's wing shall have darkened our thresholds, and the lintels of our own doors are sprinkled with the blood of our own loved ones, it will be mockery to prate of hygiene. King Humbert of Italy has recently given to the world an example of heroism and God-like courage before which the valor of that king of battlefields, who made Marengo and Austerlitz possible, must cover its face with reverence.

The cholera was raging in the city of Naples. The palace of the prince and the hovel of the wretched lazaroni alike furnished victims to appease the wrath of the insatiate demon. Consternation and dismay were everywhere. Panic seized upon the people, and the living fled from the dying. The fair Italian moon, which had looked down in tenderness and love upon the fated city, as the soft night-winds were hushed to still softer repose, as the notes of the lover's lute and troubadour's song melted and blended into a symphony almost divine, now looked pityingly upon plague-stricken Naples as she struggled in the throes of agony and death—her people dead, dying, or fleeing in terror for their lives. At this moment, when hope and courage were alike gone from the hearts of the stricken people, the brave king of Italy, with unexampled heroism and devotion, threw himself into the breach. He buried the dead, comforted the dying, and exhorted the fugitives to return to their homes and duty. His heroic example inspired the people with

courage to return and give the destroyer battle; and the result was a marked mitigation of the horrors of the plague. There is a lesson in this that we should heed. If Naples had had the benefit of the scientific knowledge and investigations of such an association as this, if Italy had but known and adopted the prophylactic sanitary measures which science proposes as the antidote for at least much of the malignity of such a visitation, the praise of King Humbert's courage would not be upon every tongue to-day, but there would be fewer graves in Naples. It may be that we cannot prevent cholera or any other disease, but we may disarm it of much of its malignity and consequent terror by the adoption of such wise sanitary and hygienic measures as have been demonstrated to be most efficient in that direction.

Mr. President: Every man, woman, and child in America is interested in your association and in the result of your deliberations; and I am sure that I voice the unanimous sentiment of the people of this commonwealth when I bid you a most cordial welcome and hearty God-speed in the great cause of humanity in which you are engaged. No profession presents so many opportunities for cool, determined, and, in one sense, uncompensated heroism as that of medicine; as that of the sanitary boards; as that of the tender, gentle-fingered female nurse upon the death-stricken fields,—whether the hooded nun, or the loving mothers, some Evangeline longing to sit by some nameless grave, or some Florence Nightingale, forgetful of self, soothing the dying and burying the dead.

Two great humanitarian conventions are now in session in this city—this one for the prevention of disease, and the relief of the diseased ones; the other one, discussing methods how to prevent crimes, and to restore the criminal to the more honest walks of life. How grand the idea that assembles such noble bodies of philanthropists. Over such conventions angels could gather in love and admiration, and then bear on tireless wings to the realms above the words of wisdom, mercy, and humanity which fall from the lips of the speakers.

I am aware of the fact that this is no ordinary occasion that brings you together. We feel that we should manifest more than ordinary interest in so important an association than by merely extending to you kind salutations. This day in which we live, this age of rapid progress, is not leaving unturned any stone that hides from view any important fact. Every thing calculated to benefit mankind is being rapidly materialized. The general diffusion of knowledge makes it possible for all men to know something of the secrets of nature, and the daily developments of national life. The investigations of your great men become common property, whether they be the learned German who has so recently traced to its foul home the germ of cholera, or the equally learned and brave Frenchman who gave up his life as a devotee to science and humanity in dissecting the dead, for the purpose of exposing to the world the antecedents, consequences, and, if possible, remedies for the dreadful scourge. Such men as these are greater heroes than the

Saladins and Napoleons of bloody battle-fields! All hail to such heroes of suffering humanity and science! No one can fail to become deeply interested in those things calculated to promote individual as well as the general good. But how intensely concerned must all become when the object sought is the removal, as far as possible, of the pains and sufferings of humanity. In the other convention now in session, How to prevent Crime is a leading theme; in this, How to prevent Disease. "What do you consider the best remedy for yellow fever?" asked one learned man of another. "The only sure remedy is to prevent it altogether," was theresponse. Much wisdom in it!

That department of human knowledge, which regards the laws governing our bodies and the agents by which they are surrounded, making them subservient to health, and warding off disease and death, is to my mind of paramount importance.

I am aware of the fact that it has been but a few years since sanitary science has obtained a place and recognition among the great body of medical and scientific men. But, like all other great truths, it has conquered a peace, and to-day stands forth with glittering banners in the very van of progress. What it can do, and what its powers are for good, remain to be seen. Judging from the past, are we not justified in saying that great possibilities are in store; that the prophecy long since made by one of your illustrious men is about to be realized; that the civil authorities will be held responsible for every case of contagious or putrid fever occurring in their midst?

There is not a citizen, I care not how humble his walk in life may be, or how exalted his position, but what must be benefited by the careful, painstaking investigations and wholesome suggestions of this honorable body.

You come to us as the Good Samaritan, as the disinterested neighbor, not merely pointing out to us the inn, the asylum where our wounds may be dressed, but you direct us into a better way, whereby we can avoid the enemies that so constantly environ us.

This practical utilitarian work is what is demanded of us all. The very genius of our government looks to the greatest good of the greatest number. Hence we bid God-speed to every laudable enterprise that has inscribed upon its banners, "*Pro bono publico*." This energized modern thought would seem to have repeopled the realms of ancient Grecian philosophy,—not with some mystic rite or metaphysical deity, but with living, everlasting truths, that teach us how to preserve our bodies in obedience to well known sanitary laws.

Again do I welcome you to the great state of Missouri. I know that you will believe me sincere in saying that we feel proud in having you amongst us, and shall take pleasure in offering you every facility in our power to aid you in your commendable work.

But a few short years ago a terrible scourge was passing over our land. In the midst of this desolation, in the very precincts of death, we find you busily at work, seeking for the morbid material that was devas-

tating like an army. We praise you for it. Coming to us from across the waters is the sad intelligence of nations in mourning. A terrible plague is sweeping over Europe. No less vigilant are your coadjutors in trying to stay the malady, not only by the application of the proper sanitary regulations, but by a more thorough investigation into the cause or causes that lie at the foundation of these terrible diseases.

By a common tie, nations and peoples feel the touch of human sympathy. This dark mantle of Nemesis may soon settle down like a pall upon our favored land. We trust that your efforts to prevent such a dreaded disaster may prove entirely successful; and when, from shore to shore, come kind words to cheer you on, I know that you will not have cause to complain of the hearty greetings extended to you by the commonwealth of this grand state.

A few years ago the fairest portion of our loved land was stricken, from Florida to Kentucky, with the most terrible scourge that ever visited humanity, striking down without mercy and without warning the strong man and the sinless babe. The wails of sorrow only grew less as the fountains of tears ceased to flow from pure exhaustion, and the hearts of the living were almost petrified from that ceaseless sorrow. Then the great North and West, forgetting in the midst of such terrible scenes that sectional lines had ever existed in this country, that "red battle had ever stamped its foot" within our borders, arraying brother against brother, sent forth words of love to the living and the dying, and burning prayers for the repose of the dead, and, also, freighted messengers and mails with the most generous contributions that were ever poured forth from loving hearts. From this city, this beautiful Christian city, a boat was ladened with everything that could give comfort to the living, hope to the dying, or honorable burial to the dead. A young officer of the United States army, too great to be named by me on this occasion, as his name is known and cherished by all, volunteered to command that vessel through this "valley of the shadow of death;" and ere his vessel had reached its destination he was stricken down, and gave up his young life for the relief of the South.

The noblest death for man to die is to die for man. Those grief-stricken people, in the midst of their own new-made graves, forgetting their own dead and dying, gathered in tears, and still deeper grief, if that were possible, over the grave of that grand young hero, and scattered over it roses in such profusion and sweetness as to conceal it from human gaze. Although that scourge developed the noblest traits of humanity, driving from human hearts all recollections of the war, and drew us closer together as a people, may we never have its visitation again; and may you, broad-minded and kind-hearted men, devise some plan, some method, to modify, if not dispel, that demon of death, together with its dreaded associations, from our loved homes.

III.

ADDRESS OF WELCOME.

By His Honor WM. L. EWING,

MAYOR OF ST. LOUIS.

Mr. President, Ladies, and Gentlemen: There can be no topic for consideration more important to humanity than that of health, and the sanitary measures to be adopted and prosecuted for its preservation. These topics have become an important factor in the discussions and reports of the sanitary organizations of the civilized world.

Not only have cities and states of the Union regularly constituted bodies for sanitary conference and work, but the federal government lends the power of its influence and medical aid, as well as the experience and coöperation of the sanitary scientists connected therewith, for the furtherance of the purposes to be attained. Thus, through intelligent conference and an interchange of positive experience, a general knowledge may be acquired, and definite plans for a general sanitary system may be consummated.

This national association, in its praiseworthy efforts to fulfil its mission and perfect the details so important to the proper conduct of its labors, exerts an influence which is felt throughout the country, and the proceedings of this annual convention will be carefully considered by all who have a proper appreciation of the great importance of the matter committed to your charge.

The people of St. Louis welcome you, and I am gratified to have been commissioned by the committee thus to express to you the kindly feelings with which they will receive you, and every endeavor will be made to render your stay in our city a pleasure, as well as a season for the interchange of profitable experience.

IV.

ADDRESS

By JOS. SPIEGELHALTER, M.D.,

CHAIRMAN OF COMMITTEE OF ARRANGEMENTS.

Mr. President and Gentlemen of the Association: In behalf of the local committee of arrangements, I have the honor to bid you the first welcome to our city. The formal and official welcome will be extended to you this evening by his honor the mayor of the city of St. Louis, and his excellency the governor of the state of Missouri.

When I was appointed chairman of the local committee last fall, I had no idea of the task which I had undertaken, and the labor connected with it. Those of you, gentlemen, who have been engaged in similar work before know what it is, and will be lenient in your judgment over deficiencies in the arrangements. I have been very fortunate in the selection of my coöperators, and am under great obligations to Dr. Geo. Homan, the secretary of the committee of arrangements, Hon. G. W. Parker, the chairman of the reception committee, Mr. N. O. Nelson, the chairman of the finance committee, Mr. H. C. Townsend, the chairman of the transportation committee, and the other members of the committee of arrangements, for their efficient and able support and coöperation. If we have not accomplished all we might have done or wanted to do, it is certainly not owing to a lack of zeal on the part of the committee. Great difficulties have been thrown in our way by the unwillingness of most of the railroad companies to grant the passes which it was our intention to procure for the officers of the association and the health officials from different states. Only a few of the railroad presidents and superintendents know and appreciate the importance of the coöperation of railroad companies and health organizations in cases of epidemics, and those few have really been very liberal in issuing passes.

The committee, in its attempt to make your stay in our city as pleasant as possible, has so far been generously assisted and supported by the business men of this city. The liberality of the gas companies will enable us to illuminate the central business part of the city in honor of the members of the American Public Health Association in the same grand style as it has been illuminated during the Fair week. This illumination will take place Wednesday evening from 7 till 9. Carriages for the members have been provided, and will be at the Southern hotel at 7:15. After a drive through the illuminated streets, the carriages will land the members at the Liederkranz hall in time for the evening session.

Friday afternoon, after adjournment, the committee proposes to take the members out in carriages through the city and the suburban parks to the residence of Mr. Henry Shaw, following the invitation kindly extended by that gentleman to the members of the association. Returning to the city in time for the evening trains, the members will be taken to their respective hotels. Those who will remain are kindly invited by the Elk Club to attend an informal reception at their club-room, corner 6th and Walnut streets, at 9 P.M.

For Saturday the programme has not yet been agreed upon, and will greatly depend upon the number of the members remaining here. In order to ascertain this, and also the number of those who wish to participate in the Friday afternoon's excursion, the members are respectfully requested to state to the registry clerk how long they intend to remain in the city.

As in former years, the Western Union Telegraph Co. has kindly established a branch office for the free use of our members.

Professor Woodward, of the manual training-school, has sent an invitation to visit his institution at any time between 9 A. M. and 3 P. M., and would like to be notified of the day and hour of the intended visit.

Mr. Dan. S. Brown has invited the gentlemen of the association to visit his green-houses, 1,301 Lewis street, where he has a very fine collection of tropical plants.

The Mercantile Club, St. Louis Club, University Club, and Germania Club have invited the members of the association to their club-rooms, and, as a matter of course, the Liederkranz Society will extend the same courtesy to their guests as far as these premises are concerned.

I would further state, that an agent of the railroad companies will be at the treasurer's office every day from 12 M. to 2 P. M. to sign certificates and give information regarding transportation. A number of guides of the city of St. Louis are to be found in the treasurer's office, and will be distributed free of charge to all the members.

And now, gentlemen, I will not detain you any longer, knowing the great amount of work which is cut out for you on this day's programme. I hope that our meeting will be a successful one, and that you may enjoy your stay with us, and take a favorable impression of the city of St. Louis home with you.

V.

ADDRESS

By Rev. W. G. ELLIOT, D. D.,
CHANCELLOR OF WASHINGTON UNIVERSITY.

Gentlemen, Members of the American Public Health Association: In coming before you this evening, under almost prohibitory restrictions of personal health, I must confess myself to be actuated chiefly by a selfish motive, namely, the desire to identify myself, in however small degree, with the great national movement which the association represents. It is closely allied, as I believe, with all the best agencies of social, moral, and material prosperity, upon which the highest interests of every community depend. Cleanliness is a great help to godliness, and soundness of the body is a great helper to soundness of mind. On the other hand, it is equally true that without a fair measure of godliness,—that is, of personal and social morality,—cleanliness of the home and person will nowhere be maintained. Whatever lowers the tone and standard of public morality, increases indefinitely the difficulty of preserving the public health. The home of the intemperate becomes the breeder of pestilence. Habits of strict sobriety will soon change the worst tenement-houses into schools of sanitary science.

Let the churches and schools, therefore, be fellow-workers with health organizations. Municipal law and police regulations may do a great deal, but their work can be made permanently successful only upon the condition of improved public opinion, and the intelligent consent of those whom we seek to benefit. Always individual personal liberty must give way to the general welfare, but for the best results willing consent of the individual must sooner or later be obtained.

There is, perhaps, no city in the Union that has experienced greater and better results from improved sanitary regulations than our own city, St. Louis. As I remember it from 1834 to 1849, it had few or no well-paved streets, no sewerage system, only a hap-hazard surface drainage, with sink-holes filled with stagnant water scattered over the city area, with Chouteau pond often overflowing to cover Market street, and creating a constant miasma for miles around, with water-works so insufficient that every one almost depended upon well-water, poisoned oftentimes by filtration from vaults and cellars. A dry cellar was the exception. Frequently, at my own residence on 8th street, where the custom-house now is, I have made a bridge with planks laid upon sticks of wood, so as to go from one part of my cellar to another with comparatively dry feet.

From such causes the city was becoming a proverb of unhealthiness, and thirty-four in a thousand was the death rate.

What wonder, then, that in 1849 the dread Asiatic cholera took strong and vindictive hold upon us! A single case in January, in the heart of the city,—then slowly increasing, with intervals of rest, until April, when it was fairly epidemic. In June it reached 120 a day, when a fierce fire broke out, sweeping away in one night a full third of the business city. We thought the fire would check the pestilence. But, no! a few days of mitigation, and then it burst out with increased virulence. In July it reached 200 in a single day, and 1,200 in a single week, and this in a population not exceeding 50,000 to 60,000! The total mortality in that cholera year from all causes was over 4,500, nearly one twelfth of the whole! In all that time the dead were decently buried; the sick, whether rich or poor, were taken care of. There was no popular fright, no general stampede. Common affairs went on as usual, though the chief occupation of all was to care for the dying and bury the dead.

The citizens of St. Louis did their own work bravely. In all that fierce trial of pestilence and fire, and the overflow of waters from the swollen river, notwithstanding the destruction of property and the absolute prostration of business, not one dollar of help was asked or received from abroad. We bore our own burden.

But we had learned our lesson; and from that day of retributive suffering, our systems of water supply and of underground drainage and of sanitary regulations bear date, with steady improvement, fault-finders to the contrary notwithstanding, until St. Louis now stands in the very foremost rank as to public health and rate of mortality among the cities of the world.

There is room enough for improvement, no doubt. St. Louis has exceptional sanitary advantages, with its great rapid river flowing by it, with its almost total absence of large tenement-houses, with its beautiful, wide-spread suburbs. It should be made the healthiest city of the United States.

It needs, I believe, only a stricter enforcement of existing laws, and the general diffusion of such sanitary knowledge as this association aims to give, and the active coöperation of our churches and charitable societies and city missions, to make it so.

May the Great Bestower of life and health give us wisdom and energy to do our work faithfully and well.

VI.

ON PHYSICAL TRAINING IN THE UNITED STATES.

BY EDWARD MUSSEY HARTWELL, PH.D., M.D.,

ASSOCIATE IN PHYSICAL TRAINING, AND DIRECTOR OF THE GYMNASIUM, JOHNS HOPKINS UNIVERSITY,

Baltimore, Md.

Philosophical speculations regarding the nature and future of man's soul and body, underlie and determine all our schemes and efforts for the nurture and training of youth. There appear to be four principal ideals of manly excellence, which, singly or in combination, have dominated the minds of the promoters and governors of educational foundations, and in accordance with which physical training has been favored, tolerated, neglected, or condemned. We may characterize these ideals as the Greek or æsthetic, the ecclesiastical or monkish, the military or knightly, and the medical or scientific. The first three have been influential in varying degrees from the earliest times: the fourth, though compounded in a measure of ancient elements, is so strongly tinged with utilitarian and psycho-physical ideas as to be best described as modern. All these ideals are traceable to conceptions of human nature and destiny, which may be roughly classed under the two heads of lugubrious and cheerful.

Charles Kingsley has well characterized the Greek ideal as follows: "To produce health,—that is, harmony and sympathy, proportion and grace, in every faculty of body and mind,—was their notion of education." The antithesis between the Greek and the ascetic ideal is clearly indicated in a remark of Apuleius concerning Egyptian and Greek modes of worship. "The Egyptian deities," he says, "were chiefly honored by lamentations, and the Greek divinities by dances." Monasticism, which was the extreme expression of the ascetic spirit, was of Asiatic, and to a considerable extent of Egyptian, origin; and, after the first two or three centuries of the Christian era, exercised a profound influence on European thought and life. "The duty of a monk," said St. Jerome, "is not to teach, but to weep." Weeping and self-torture might well absorb the energies of men who championed such beliefs as that body and soul are independent and hostile entities; that "the greatest of evils is pleasure, because by it the soul is nailed or riveted to the body;" and that mental and spiritual health are best subserved by bodily weakness. Though such views were generally treated as heretical by the early fathers of the church, yet they became dogmas of the mediæval church of Rome, and you may find similar doctrines, far from faintly echoed, if

you search the sermons of Scotch, English, and American divines, who have labored within the last three centuries to establish or perpetuate religious terrorism.

Side by side, when not confronting it, with the ideal of the monk, has stood the ideal of the soldier and the gentleman. Until the establishment of industrialism in civilized countries, the military ideal exercised a most potent influence in the education of the sons of gentlemen throughout Europe. Herodotus tells us that the sons of the Persians, "from their fifth to their twentieth year, were carefully taught three things only,—to ride, to draw the bow, and to speak the truth." "Plaienge att weapons" formed a necessary part of every gentleman's education in England, as well as on the continent, as late and even later than the sixteenth century. "I swear I'd rather that my son should hang than learn letters [benefit of clergy saved many a neck in those days]; for it becomes the sons of gentlemen to blow a horn nicely, to hunt skilfully, and elegantly to carry and train a hawk, but the study of letters should be left to the sons of rustics." These are the words of an English gentleman in the time of Henry the Eighth, who, on hearing letters praised, was "aroused to sudden anger, and burst out furiously."

The ideal of the Greeks sprang from a passion for beauty and harmony, and a joyous sense of well-being. That of the theologian and the monk was conditioned by a profound ignorance of and a bitter contempt for the body; while that of the soldier and the knight owed its peculiarities to a rude appreciation of bodily force and skill, based upon the experiences gained in camp and field. It is not to the generative power of any or all these ideals, unless it be the Greek, that we owe our modern doctrine of the interdependence of mind and body, which doctrine is but vaguely, if at all, apprehended by the majority of those who quote with generous unction the time-worn injunction of Juvenal, "Pray for a sound mind in a sound body." The next line, "Ask for a brave soul unscared by death," they usually omit. No, the belief "that to work the mind is also to work a number of bodily organs; that not a feeling can arise, not a thought can pass, without a set of concurring bodily processes," is the child of the scientific spirit, and was engendered through the labors of Harvey and Haller, of Du Bois Reymond, Weber, and Helmholtz, and Wundt.

When we recall the fact that our oldest American colleges, like their early English models, were established primarily to furnish trained recruits to the ranks of the clergy, there remains no ground for wonder that physical training has been slow to win recognition as a necessary part of a sound education. American educators were long ruled by British notions as to curriculum and discipline, which notions have never been in favor of systematic physical training. Certain national sports, however, have long been considered by the educated class as constituting an important bulwark of the British constitution. Accordingly American collegians, those who were not too serious to play, disported themselves after inherited British fashions. The means afforded

students for sports a hundred and fifty years ago were decidedly meagre, if we may judge from the only mention concerning them in the "Ancient Customs of Harvard College, established by the government of it," in which "Custom 16" reads thus: "The freshmen shall furnish bats, balls, and foot-balls for the use of the students, to be kept in the buttery." The first president of Dartmouth college, Dr. Wheelock, admonished his students in 1771, two years after the college was opened, "to turn the course of their diversions and exercises for their health to the practice of some manual arts, as cultivation of gardens and other lands, at the proper hours of leisure and intermission from studies and vacancies," *i. e.*, vacations. We learn from a letter written by Dr. Benjamin Rush, of Philadelphia, in 1790, on "The Amusements and Punishments proper for Schools," in which, by the way, he commends the Methodists for "wisely banishing every specics of play from their college," that the experiment had been tried, "with the happiest effects," of introducing the care of vegetable gardens as an amusement "in the Methodist college at Abington in Maryland." He also says that "all the amusements of the children of the Moravians at Bethlehem, Pennsylvania, are derived from their performing the subordinate parts of several of the mechanical arts, and a considerable portion of the wealth of that worthy and happy society is the product of the labor of their little hands." Fifty years later manual labor societies came into vogue in several of the New England colleges, but, proving failures as a means of putting wealth into the hands of their members, they fell into desuetude as educational agencies. In some colleges the authorities used to grant holidays "for the purpose of fostering in the students the habit of physical labor and exercise, so essential to vigorous mental exertion," which holidays were devoted to "raking off the chips, and clearing the grounds, and gravelling the college walks."

When such notions and practices obtained with our forefathers, it is hardly strange that the first impulse to a physical training deserving of the name should have come from without. As a matter of fact it came from Prussia, where during the last fifteen years of the eighteenth century and the first two decades of the nineteenth, Gutsmuths and Jahn, the father of the German Türnvereins, accomplished a great work in reviving physical education. Enamored of the Greek ideal, they strove in an elaborately systematic way to embody Greek gymnastics in modern forms. The first gymnasiums in this country were constructed out of doors, in bald imitation of Græco-German models, and a very considerable, though as it proved a very transient, interest in gymnastics was evoked by German exiles. Drs. Beck, Follen, and Lieber were foremost in the matter. In 1828 there was published in Northampton, Mass., "A Treatise on Gymnasticks, taken chiefly from the German of F. L. Jahn." This translation was by a pupil of Jahn's, Dr. Beck, who had in 1825 been instrumental in establishing a gymnasium at the Round Hill school in Northampton. On page iv of the preface Dr. Beck states that "The school of Messrs. Cogswell & Bancroft, in Northampton,

Mass., was the first institution in this country that introduced gymnastick exercises as a part of the regular instruction, in the spring of 1825."

I am greatly indebted to the venerable Dr. George C. Shattuck, of Boston, who was a pupil at Round Hill, for the following account of this gymnasium: "Dr. Beck, the teacher of Latin, afterwards the professor of Latin in Harvard University, was the first teacher of gymnastics. A large piece of ground was devoted to the purpose, and furnished with all the apparatus used in the German gymnasiums. The whole school was divided into classes, and each class had an hour three times a week for instruction by Dr. Beck. At the same time there were a dozen riding horses, and classes for riding three times a week. Gardens were assigned the boys, in which they raised plants and vegetables. A piece of land was set aside for building huts. Base-ball, hockey, and foot-ball were the games. Though the school had only an existence of twenty years or less, and failed from the want of pecuniary support, I believe that its influence has survived. Developing the bodily powers and strengthening the constitution were there first recognized as of great importance in the education of boys."

Dr. John C. Warren, who for forty years was professor of anatomy and surgery in the Harvard Medical School, was about this time in the habit of delivering annual lectures to the students at Cambridge on the preservation of health. He was the first president of the Tremont gymnasium in Boston, in whose establishment in 1825 he took a prominent part. It is a matter of interest that Dr. Warren attempted to secure the services of "the distinguished philosopher and gymnasiarch, Professor Jahn," who could not be led, at the salary offered, "to abandon his own country and establish himself in ours." Dr. Francis Lieber, who later attained such eminence as a publicist and as professor in the Columbia Law School, was for a time connected with the Tremont gymnasium. In 1826 Dr. Follen, who, like Dr. Beck, was a teacher at Round Hill, and finally became a professor at Harvard, established a gymnasium at Harvard college, being seconded in his efforts by Dr. Warren and others of the "medical professors." "One of the unoccupied commons halls was fitted up with various gymnastic appliances, and other fixtures were erected on the Delta," *i. e.*, the college play-ground. In the same year (1826) the corporation of Yale college voted the sum of $300 for the fitting up of a gymnasium on the village green. Dr. Warren states that "small gymnasiums were established in connection with most of the schools, academies, and colleges, male and female." The following extract from the published works of Dr. Warren, though I am uncertain whether it was originally penned in 1830 or 1845, affords good evidence that the interest in gymnastics became feeble after the first teachers of the art became ordinary college professors. "The establishment of gymnasia," says Dr. Warren, "through the country, promised at one period the opening of a new era in physical education. The exercises were pursued with ardor so long as their novelty lasted, but owing to not understanding their importance, or some defect in the institutions

which adopted them, they have gradually been neglected and forgotten, at least in our vicinity. The benefits which resulted from these institutions within my personal knowledge and experience far transcended the most sanguine expectations. The diversions of the gymnasium should constitute a regular part of the duties of all our colleges and seminaries of learning."

It would appear that no well considered and systematic course of physical training was maintained for any considerable length of time in the period extending from 1826 to 1860 in any American college. It may be possible that the University of Virginia presents an exception to the above statement, inasmuch as there was a large out of doors gymnasium maintained on the grounds of that institution from 1852 till the outbreak of the war. A competent gymnast and fencer had it in charge, but in order to support himself he was obliged to eke out the small sums received from the students by cultivating a kitchen garden and keeping a Russian bath-house.

Although in the period from 1855–1860, under the combined influence of the writings of Dr. Winship, Dio Lewis, Thomas Hughes, and other writters, much interest, especially amongst young men, was awakened in gymnastics, feats of strength, and athletic sports, still prior to 1859 no college in the country possessed a commodious and well furnished building devoted to the purposes of physical training. In the year 1859–60, however, Amherst, Harvard, and Yale erected gymnasiums which cost respectively $15,000, $10,000, and $13,000. These, for their time, were costly, elaborate, and well furnished. Those at Amherst and Harvard having been outgrown, have recently been replaced by more costly and vastly improved structures, of which we shall have occasion to speak further on. From the outset, compulsory exercise of all able-bodied students has been required at Amherst, under the control and direction of an educated physician whose professorial chair was given an equal standing with all others at the faculty table. Gymnastics at Harvard have never been required, I believe. Dr. Sargent was made assistant professor of physical training and director of the Hemenway gymnasium in 1879. His predecessors were a professional teacher of boxing and a military drill-master. At Yale no very comprehensive or commendable system has as yet been adopted.

A consideration of the salient facts regarding the department of hygiene and physical education of Amherst college is well worth our attention at this point; for, as has been well said by President Eliot, of Harvard,— "It is to Amherst college that the colleges of the country are indebted for a demonstration of the proper mode of organizing the department of physical training." As was stated, the department was at the outset put into the hands of a physician. Dr. J. W. Hooker, the first incumbent, resigned his charge before the end of the year 1860. Dr. E. Hitchcock, Sr., a graduate of Amherst, and of the Harvard Medical School, still holds the professorship of hygiene and physical education to which he was appointed in August, 1861. Dr. Hitchcock's duties have been and

still are of a three-fold nature, namely,—1st, of lecturer and instructor in anatomy, physiology, and hygiene; 2d, of director of the gymnasium; 3d, of health officer of the college.

At the Chicago meeting of this Association, in 1877, Dr. Hitchcock read a paper detailing the history and workings of his department, and later, in 1881, published "A Report of Twenty Years' Experience in the Department of Physical Education and Hygiene in Amherst College." In the latter are six valuable statistical tables derived from his health and anthropometrical records, covering the period 1861–1880. The paper and the report will well repay perusal by those who may be interested in the details of the Amherst experiment. The following extract from the paper alluded to may serve to indicate the means of training employed at Amherst:

"Each of the four classes in college meets the professor for an exercise in the gymnasium of half an hour's length, on four days in the week. In this way the student presents himself for a public visit to the professor, and may always have a private interview either before or after the exercise, if either desires it. The hours for exercise are mainly at the beginning and close of the day, as both the most valuable time for exercise, and those which best adapt themselves to the college routine. Each class has its own captain and as many other officers as are best adapted to manœuver and handle the class in its movements. The general method of the conduct of the exercises is military, though considerably modified to be adapted to the peculiar condition of things. The required exercise of each man and class is best known as that of light gymnastics, or those bodily exercises performed by a class with one or two pieces of apparatus in the hands, each movement timed to music, and all simultaneous and uniform. And the only apparatus successfully used at Amherst is the pair of wooden dumb-bells, weighing less than a pound apiece. The students here have universally preferred the bells to the rings and wands, though they have been thoroughly tried. Each class has its own "exercise" or series of bodily movements with the bells, and these are so managed as to give free, lively, graceful, and vigorous work to the whole muscular system during the time of the exercise. In addition to the bell exercise, marching by the file and flank is considerably practised, and during the cold months, running or 'double-quick' movements. This running is encouraged that the student may gain the very valuable assistance that it gives to the 'wind' by furnishing warm air to the lungs, and a more rapid relief by sweating, and greater freedom to the body by the lesser amount of clothing required than if the necessary amount were taken in the cold temperature of out-of-doors. This exercise varies from fifteen to twenty minutes, and with the temperature from 55° to 60° the student almost always finishes with a moist skin. The remainder of the half hour is occupied in voluntary exercise. Some use the heavy apparatus—about one in eight—or take a longer run; others dance, use clubs, sing, pull rope, toss in the blanket, turn somersaults, and occupy themselves in any proper manner to secure exercise, sport, or recreation."

The list of colleges which provided their students with gymnasiums during the period covered by Dr. Hitchcock's report is a considerable one, and includes such institutions as Beloit, Bowdoin, Dartmouth, and Princeton colleges, Brown, Wesleyan, and Vanderbilt universities, and Phillips Andover Academy and Williston Seminary, for young men, and Wellesley and Vassar colleges and Mt. Holyoke Seminary, for young women. In none of them, however, has the course adopted been so comprehensive as that at Amherst, or so carefully and continuously carried out. Brains and funds have been too often lacking in this department during the period named.

At the request of the vice-minister of Japan, who visited Amherst in 1876, G. A. Leland, M. D., gymnasium captain of the class of 1874 at Amherst, was designated by President Seelye to introduce the Amherst system of gymnastics into the government schools of that country, and for three years he was engaged in that work to the "high satisfaction of the government."

In 1869 the Princeton college gymnasium was built at a cost of $38,000, and from then until the completion of the Hemenway gymnasium at Harvard it was the first in the country. For fifteen years Mr. George Goldie, a most competent and successful teacher of gymnastics, has been its superintendent. His pupils have been noted for high proficiency in acrobatic feats.

One of the most potent factors in bringing about the revival in recent years of an interest in exercises, games, and training, was the war. With the war came a genuine appreciation of the worth of a good physique and of the educational value of bodily training. After the war the youth of the country engaged more actively, enthusiastically, and intelligently than ever before in athletic sports, and collegiate and inter-collegiate contests in great variety gained unexampled prominence and favor in the estimation of the general public as well as of the college world. I do not propose to enter into the discussion of the vexed question of athleticism in colleges. My belief is, that in the larger colleges the athletic spirit has gained such headway that no college can afford to crush it, that it ought not to be crushed, and that under control it is susceptible of being turned to the utmost advantage of the students. The spirit of inter-collegiate rivalry should be kept within reasonable limits, and every tendency towards professional methods and practices should be discountenanced.

A few facts concerning the play-grounds of Harvard, Yale, and Princeton, and the sums raised and expended in a single year, may serve to indicate how highly developed an interest that in athletics has become, and it should be remembered that it has been developed and organized chiefly by the students and alumni of the last twenty years, who have also contributed munificently towards the erection of our finest gymnasiums. Dr. H. I. Bowditch, in his Centennial Address on Hygiene in America, in 1876, predicted what is in a measure already fulfilled. "Meanwhile," he said, in speaking of hygiene in colleges, "although the instructors of the colleges thus neglect important duties, the youths of their own free will, and at times, lately, with the aid and counsel of the college governments, have commenced athletic sports. This will gradually force the colleges to take on their own parts a higher position." The playing-fields at Harvard, on grounds belonging to the college, embrace about ten acres of land in the heart of the city of Cambridge. Within eighteen months more than $6,000, of which the college contributed $2,000, have been expended in improving them, so that the facilities for ball-playing, tennis, lacrosse, bicycling, and running, are ample and excellent. The new athletic field at Yale will, by the time it is ready

for use, have cost about $56,000, which sum was chiefly contributed by students and graduates of the college. "It will embrace a quarter-mile cinder track, two ball-fields, a foot-ball field, and a cricket field. It has on it a $6,000 grand-stand, and is enclosed by a wire fence, surrounding nearly thirty acres of land." The director of field sports at Yale, who was in college distinguished both as a student and as an athlete, was appointed a year ago by the graduate and undergraduate athletic interest at a salary of $1,200, towards which the faculty paid nothing. Both Harvard and Yale have large and valuable boat-houses. Princeton has an athletic field of nearly ten acres, well appointed for field sports. The following table shows the financial condition of the athletic departments of Princeton, Harvard, and Yale, for the years 1882–83:

Name.	Numbers.	Expenditures.	Income for 1882–83
Harvard	1,428	$15,542.44	$18,056.82
Princeton	500	4,252.17	4,293.78
Yale	1,050	17,476.04	18,048.03
Totals	2,978 students.	$37,270.65	$40,398.62

It may be said, in passing, that not a tithe of the attention given to athletic sports at the Northern colleges is discoverable in those of the South. Military drill is the favorite form of physical training at the South. Since the war military schools for boys have multiplied at the North, and all state colleges organized under the Morrill land grant act are obliged to teach military drill. A few have evaded this provision, but most are glad to secure the services of a specially detailed officer of the U. S. army as instructor in drill and tactics. The fullest data yet accessible to me show that out of forty-five colleges which attempted in 1882–'83 to give a course in physical education, thirteen employed military drill. Military drill is well adapted for preparatory students, and has worked well in many new institutions; but he would be a bold man who should undertake to make it compulsory at Harvard, Yale, or Princeton. Paternal government is breaking down in our best colleges, and military discipline cannot be erected on its ruins.

Unquestionably the best considered and most successful experiments made to secure physical training in this country are those which have been carried out at the U. S. military academy and at the U. S. naval academy: it is therefore eminently desirable that the recorded experience of those institutions, touching the physique, health, and longevity of their cadets and graduates, should be made available as an example and stimulus to the managers of our scholastic youth. I am convinced that no class of our students, with the possible exception of the picked athletes, will bear comparison with the West Point and Annapolis cadets, as regards mental and bodily vigor.

A great impetus was given to the cause of physical education by the building of the Hemenway gymnasium of Harvard college in 1879, and the adoption therein of Dr. Sargent's system of developing gymnastics, Dr. Sargent being made its director. I shall not undertake to describe the Sargent machines, or the Sargent system. Dr. Sargent spoke for himself and for his own views before this association at its last meeting. I may be allowed to say, however, that I deem it the most scientific system yet adopted in this country, and that in many ways it is an advance on the class gymnastics which have so long been used at Amherst. The measurements made at Amherst had no relation to the exercise of the individual Amherst student,—*i. e.*, they were used for statistical and not for diagnostic purposes. According to the Amherst system, two men, the one having a flat chest and the other a slight spinal curvature, would be given the same exercise. Under the Sargent system, which, by the way, has been adopted in a large measure at Amherst, the men would have totally different kinds of exercise prescribed. More than forty gymnasiums have been fitted wholly or in part with the Sargent appliances.

Exercise is prescribed, on the developing machines, on the basis of a careful examination and series of measurements made of the person receiving the prescription, in the following named institutions:

Harvard University, Cornell University, Johns Hopkins University, Lehigh University, Amherst College, Smith College for Women, Hartford Theological Seminary, Y. M. C. Union Gymnasium, Boston, Sanatory Gymnasium, Philadelphia, Sanatory Gymnasium for Women, Cambridge, Mass., Penn Charter School, Philadelphia, the National Deaf Mute College, and Haverford College.

That means that many thousands of anthropometrical measurements and tests are made annually on school and college students, male and female, and also on clerks and mechanics. The importance of such statistics in determining the natural history of the average and mean adolescent, male and female, is too obvious to require remark.

There are probably not far from fifty college gymnasiums or drill halls in the United States. Of these the best are the Hemenway gymnasium, costing $110,000, the gift of A. Hemenway, Esq., of Boston, and a recent graduate of Harvard, to his Alma Mater; the Pratt gymnasium at Amherst, just completed at a cost of $77,000, named for C. S. Pratt, Esq., of Brooklyn, and a graduate of Amherst in 1879, who gave $38,000 towards its erection; the Lehigh University Gymnasium at Bethlehem, Pa., built out of university funds in 1882 at a cost of $40,000. These three gymnasiums are far superior to any others in the country, if we except the gymnasium now building for the New York Athletic Club, which, it is estimated, will cost upwards of $200,000, and is planned to be the largest, most complete, and most elegant building in the world devoted to the purposes of physical training. The Harvard, Amherst, and Lehigh gymnasiums are all sightly and elegantly finished structures, fitted with the most recent gymnastic and sanitary

appliances. Each has a running-track, commodious dressing-rooms, generous bathing facilities, and convenient offices for the directors. Each has several bowling-alleys, and those of Amherst and Lehigh have billiard-rooms, with tables. The gymnasiums at Amherst, Cornell, Harvard, Haverford, and Johns Hopkins are in charge of regularly educated physicians.

There are new gymnasiums building at Bryn Mawr College for Women, Dickinson College, and Lafayette College, all in Pennsylvania, and a new gymnasium is projected at West Point. These will cost upwards of $50,000 it is estimated.

The colleges have, however, not yet emerged from the building stage of development as regards their departments of physical training. It is easily susceptible of proof that the best of them has not yet reached such a highly organized and differentiated state as to promise the best results. More generous endowments are needed, and a fuller complement of teachers is called for. There is a crying need for scientific medical direction on the one hand, and for competent teachers of gymnastic specialties on the other; but there is reason to hope that this need will be met before many years elapse.

Before physical training shall constitute a part of the regular course of instruction in the public schools of even the most enlightened states, a vast number of trustees, committee-men, teachers, and physicians must be educated, as they are not now and never have been, in regard to personal hygiene in all its branches. As a rule, the medical schools make no attempt to teach those who bear away their diplomas how to recognize a normal man or woman; and so long as the average medical man is indifferent or ignorant on the subject of physical training, which, in the last analysis, is a training of the nervous system, we cannot expect teachers, either in school or college, as a class, to have intelligent practical notions on this subject.

By showing what has been done, and pointing out what might be learned and carried into practice in this field of hygiene, the American Public Health Association can do much to further the ends for which it was established.

Table showing the cost of the principal gymnasiums and drill halls built in the United States since 1860.

In the period 1860–1870 gymnasiums were built as follows at

Amherst College in 1859–1860, at a cost of	$15,000
Dartmouth College in 1866, "	24,000
Harvard University in 1859–1860, "	10,000
Pennsylvania College in 1870, "	3,000
Princeton College in 1869, "	38,000
Washington University in 1870, "	7,000
Wesleyan University in 1863, "	5,000
Williston Seminary, "	20,000
University of Wisconsin in 1868, "	5,000
Yale College in 1859–1860, "	13,000
	$140,000

In the period 1870–1880 the following gymnasiums were built at

Beloit College in 1874, at a cost of	$5,000
University of California in 1878, at a cost of	12,000
Harvard University in 1879, "	110,000
Newton Theological Seminary in 1876, at a cost of	4,000
Smith College for Women in 1880, "	4,000
Vanderbilt University in 1879, "	22,000
	$157,000

In the period 1880–1884 the following named gymnasiums were built at

Amherst College in 1883–'84, at a cost of	$77,000
Cornell University in 1882–'83, "	40,000
Johns Hopkins University in 1883, at a cost of	10,000
Lehigh University in 1882, "	40,000
Mass. Agricultural College in 1883, "	6,000
University of Minnesota in 1884, "	34,000
National Deaf Mute College in 1881, "	14,600
Tufts College in 1882–'83, "	10,000
University of Wooster in 1882–'83, "	4,200
	$235,800
	157,000
	140,000
Total 1860–1884,	$532,800
Estimated cost of fitting gymnasium in buildings, used partially for other purposes, and of gymnasiums now building,	125,000
Grand total,	$657,800

NOTE. It is proper to state, that the data used in preparing this paper belong to the United States Bureau of Education, and will be embodied in my forthcoming Report on Hygiene in American Colleges and Universities. It is due to the kind permission of Gen. John Eaton, commissioner, that I have been enabled to prepare this paper.—E. M. H.

VII.

SCHOOL HYGIENE.

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In the whole science of hygiene there is perhaps no more important subject than the study of childhood and its proper sanitary direction. In order to promote the welfare of society, we must begin by legislating for the benefit of the rising generation. Children to-day, men and citizens to-morrow, upon you will devolve the duties and responsibilities of government, the care and obligations of family. In your hands in a measure rest the destinies of a nation. That plant will yield the finest fruit which has received at the hands of the gardener the most assiduous care and intelligent cultivation. In a like manner intelligent hygiene will skilfully develop and transform weak and delicate children into strong, robust, and useful citizens.

Within the last few years legislators and hygienists have devoted time and labor to the study of the hygiene of children in all its aspects, and numerous laws have been passed for the improvement of their sanitary conditions. Earnest and philanthropic efforts have been made in that direction in every country. Real and unmistakable progress has been accomplished, yet much remains to be done. The mortality among young children is still frightful in many countries, and its main causes are the ignorance among the masses of the simplest notions of hygiene, and the numerous prejudices existing even among the higher classes. Societies for the protection of children—of more vital importance to the community than those established for the protection of animals—should exist in every city of America. They would spread among the masses such sanitary notions as would greatly diminish diseases and mortality of young children.

In some cities of France small tracts relating to the proper nursing of children are distributed free of charge to all persons registering the birth of a child. Why should not such a useful system be adopted in this country by our municipal authorities and boards of health? Those tracts have in many instances reached their twentieth edition, and been translated in all languages. These popular instructions have had excellent results in preventing premature deaths and accidents of different kinds: for instance, blindness from purulent opthalmia in infants has become of late much less frequent than formerly.

It would be interesting to mention here the varied measures instituted within the last few years by the governments of Europe for the protec-

tion and development of children, especially in large cities. Among those measures is the enforcement of laws creating free public schools and making education compulsory. In England, France, Germany, and Italy, the common-school system has been extended to the smallest village. In all large cities are to be found public free schools, richly endowed, and offering every facility for a thorough and complete course of studies. The London public schools, for example, are admirably organized. The expenditures for its vast system of public education amount to a total of $7,000,000 annually. More than 562,000 pupils attend these schools; the staff of teachers comprises 3,500 adult and 1,500 pupil teachers, or monitors. About 8,000 children have been fitted and sent from these schools to higher industrial schools. The appropriation for public education in England is about $20,000,000 annually. There are 150 inspectors who visit schools throughout the kingdom: their salaries vary from $2,000 to $4,000 per year. In France, since the establishment of the republican government, immense progress has been made in the cause of public education. In 1882 the government's subsidy to the communes, in order to enable them to conform to the new law on compulsory non-sectarian education, amounted to the sum of 50,000,000 francs: the departments contributed 25,000,000 francs, and the communes 60,000,000, a total of 135,000,000 for primary education alone. In Italy great progress has also been accomplished. Public education is now made compulsory by law, and government, departments, and municipalities appropriate large sums of money annually for the extension and improvement of their public schools. The city of Turin, with a population of about 275,000 inhabitants, has spent within the last three years the sum of 3,000,000 francs for the improvement of its public schools.

In our country, under the enlightened influence of republican institutions, the people have long been able to appreciate the benefit of general public education, and our system of schools has been studied and adopted by every civilized country. A majority of our states have adopted laws making free education compulsory.

According to the census of 1880 there are in the United States not less than 9,800,000 children enrolled in public schools, with about 282,000 teachers, more than half of whom are ladies. The expenditure for public schools amounted during that year to nearly $80,000,000. As is well known, in our country provision for popular education is left to the exclusive control of states. The proposed plan of national aid to the several states, for the purpose of promoting public education according to the needs of the respective states, has not apparently met with popular favor. This year there are not less than 300,000 children attending the public schools of New York city, an increase of 10,000 over last year. Besides the elements of a good English education, they receive free instruction in music, drawing, French, or German. Both sexes, with an exception or two, follow the same course of study. The expenditure for these schools is put down at $4,500,000 a year. There are 4,000 teachers, the great majority of whom are ladies. The highest salary paid to a

man is $3,000; to a woman $1,900. The new compulsory education law requires fourteen weeks' schooling in the year for every child in the city.

More than ever of late this subject of education has absorbed the public mind, and notable progress has been accomplished in every part of our country, extending to the remotest section of the South. Everywhere schools have been established. Even among our colored population the benefit of free education is being gradually felt. But of what avail would schools be without school hygiene?

School hygiene is the study of those sanitary conditions which impress their mark and influence, for evil or for good, over the whole organism and future life of the child. Is it not as necessary to teach to our children the road that leads to health, as that which leads to fortune? The latter will often depend upon the former, whilst without health riches are of no value, and life has no charm.

Modern education should cultivate physical as well as mental development. They should accompany each other, or, rather, the physical should precede the mental development, for, without a proper physical basis or foundation, the premature and isolated culture of intellect would soon be followed by organic waste and exhaustion. *Mens sana in corpore sano* should be the aim of a correct and philosophical system of education.

The ignorance or neglect of hygienic laws relating to the school-life of children is the cause of many physical lesions or infirmities which are in a great measure preventable. Incorrect and awkward sitting postures, for instance, kept up for many hours daily on badly constructed benches, not adapted to the size and age of the scholar, will give rise to vicious attitudes, to deviation of the vertebral column, to cardio-pulmonary trouble; close confinement in crowded and badly ventilated rooms will produce chlorosis, anæmia, and all their results; improper light, the use of badly printed books, will produce defective accommodation of the eye-globe and myopia; excessive studies, without any regard to the age and personal aptitude of scholars, the system of cramming, so generally followed nowadays, will bring on cerebral excitement, nervous susceptibility, predisposition to neurosis,—the disease of the day,—and, finally, cerebral inertia and impairment of intellectual functions. All these baneful consequences can be avoided by a proper physical and mental school programme, adapted to the age and intellectual capacity of the child, and fulfilling the *desiderata* of hygiene.

SCHOOL-HOUSE—ITS SANITARY CONDITIONS; MODE OF HEATING, LIGHTING, VENTILATION; ITS FURNITURE, ETC.

A school-house should be, as far as practicable, centrally located, of easy access, well ventilated, properly heated, and removed from all noisy, unhealthy, or immoral neighborhoods,—far from cemeteries, factories, places of amusement, unsanitary establishments, and nuisances of all kinds.

Its superficial area should be calculated at 10 yards per scholar. In no case should it be less than 500 yards. Its exposition should be determined by the climate and sanitary conditions of the locality. There should be distinct departments for boys and girls. The school-house yard should be large, airy, clean, dry, and well drained. A proper shed is useful for rainy days, and during the hot days of summer. Roads leading to the school should be kept in good order, to avoid both dust and mud. The maximum number of scholars to each class-room should be 50, if there is but one class-room, and 40 if more than one. Each scholar should be entitled to not less than $1^{m}\ 25^{c}$ surface room, and 5 cubic metres of air. The rooms should be rectangular, the ceilings high. These, as well as the walls, should be smooth, without cornices or ornaments. The windows should be high and wide, and so disposed as to secure perfect ventilation. The proportion of window space should equal 40 to 50 per cent. of the floor space.

Unilateral light should always be preferred when practicable. When bilateral, it should be stronger on the left than on the right side. The light should not be too intense, as it increases the heat in summer, fatigues the eyes, and gives rise to dizziness and headache. It should be moderated by the proper use of awnings and window-shades. The walls should be unpapered, and, when practicable, covered with stucco, or plaster painted in oil colors. Miasmata and dust do not stick to oil or stucco surfaces, which can be easily washed. The color of ceilings and walls is by no means indifferent. White walls are unfavorable and irritating to the eyes, especially with lymphatic and scrofulous subjects. The most desirable color would be a light green or light blue above, with darker shades below.

The floorings should be cemented, or made of hard wood and well polished. Spitting on the floor or wall should be strictly prohibited. Besides being unclean and unrefined, this habit may have pernicious results. Since the discovery of the *bacillus* of phthisis, it is natural to believe that sputa may transmit the disease by the diffusion of the *bacilli* in the atmosphere. Sore throats and diphtheria may very likely be transmitted in the same manner. Has it not been shown that the secretions of certain contagious diseases do not lose their virulence even after having been dried, offering a certain analogy with the blood of animals dying of splenic fever, which blood may be dried and kept for years, and pulverized into dust, and yet contain living germs capable of reproducing the infectious disease?

Spittoons containing proper disinfectants,—solution of sulphate of iron, or chloride zinc,—should be used in all school-rooms; and, besides, the bad habit of spitting, so common in some parts of our country, should be discouraged as far as possible. It has been said that in Berlin the school-room discipline is so severe as even to forbid coughing. If such be the case,—no doubt, in the majority of cases, a strong effort of volition will prevent coughing,—it ought to be easier to prevent spitting.

Great attention is required for the proper ventilation of the school-

rooms, especially during the winter. Impure air should be constantly renewed by currents of pure heated air. In the coldest days renewal of impure air should be secured without exposing children to draughts. As a rule, school-rooms are too much heated. A temperature of $+15°$ centig. is quite sufficient. Heating by means of steam or gas is to be preferred to any other. The first cost of fixtures, which is rather expensive, will be greatly compensated by the economy of combustible, its cleanliness and its facility of maintenance. When furnaces are used, proper precautions should be taken for the constant renewal of pure air.

Special attention should be paid to the construction of water-closets and urinals. In schools, as well as in soldiers' barracks, they often become active foci of disease. Cholera, typhoid fever, dysentery, diphtheria, and other diseases of a contagious or infectious character, are often propagated and spread by means of defective water-closets. A single individual, in a school or soldiers' barracks, may be the means of developing a violent epidemic. At times, a student in the premonitory symptoms of typhoid fever, having only a slight diarrhœa, is taken with fever, and goes home, after having introduced the germs of the disease in the school closet. At other times, a convalescent of typhoid fever reënters school, bringing along with him the disease germs. Dr. Budd, of Bristol, has noticed three epidemics of typhoid fever in schools by the return of convalescing scholars having only a slight diarrhœa. The same has been observed in military barracks. Certain epidemics of diphtheria have been traced by investigation to the deplorable condition of water-closets.

Modern researches on the infectious nephritis of typhoid fever and diphtheria, with corresponding alteration of urine, compel us to consider urinals almost as dangerous, in some cases, as closets, and requiring the same precautions.

The possibility of transmission of certain diseases, such as dysentery, scarlet fever, diphtheria, measles, etc., for a certain period of time after the subsidence of all symptoms, is a well known fact; and strict rules should be enforced, fixing the number of days that should elapse in each case between convalescence and the return to school. That number of days should vary from twenty to forty; and all children affected with any of the above named diseases should take several baths, and undergo disinfection at home, before returning.

A sufficient number of urinals and closets should be established for each school—not less than four for one hundred scholars. They should be properly constructed, and always kept clean, ventilated, and thoroughly disinfected. When water-closets proper cannot be introduced, *earth closets*, often renewed, should be preferred to permanent vaults.

School furniture, benches, seats, and desks should occupy our attention for an instant. This subject is of great importance, if we should judge from the numerous varieties of school furniture proposed in every country. It has been calculated that, at the rate of forty weeks schooling per year, children spend during the beautiful years of their youth, when

physical development is most necessary, not less than 12,360 hours on school benches, without counting hours of study at home! With imperfect seats and desks, these prolonged sitting postures may and do give rise to very serious consequences, the least of which are faulty attitudes, deformities of spine, and myopia. Tables formerly used, with benches attached to them, for four, six, and eight scholars, are bad, as children cannot be so easily watched, and because the whole bench is disturbed every time a scholar in the centre wishes to come in or go out. New models of combined chairs and desks, for two children, are greatly to be preferred. They should be graded, in four or five numbers, according to the size of children. They should have a back and a foot-rest. The seats should be sufficiently wide, and so constructed as to support not only the pelvis, but part of the thigh. The lid of the desks should be movable, and present an inclined plane, better suited for reading and writing with ease and comfort. Hat-racks should not be used indiscriminately for a number of scholars. They are frequently the means of transmitting parasitic affections. Each child should have a separate hat-rack, or a simple polished nail, for his own exclusive use, with his name over it. It would be a good rule to require all boys to have their hair closely cut, and all children affected with parasitic diseases should be immediately removed from the school-room. Solidity, simplicity, and cheapness are among the first requisites of school furniture.

Proper attitude of scholars while sitting at their desks should be strictly enjoined, and in order to obtain it constant surveillance is required from teachers. Children should not be allowed to lean forward on their desks, to bend or twist sidewise their bodies, to have their noses in their books whilst reading or writing: it has been noticed that they lean forward in writing much more than in reading. The scholar should sit squarely on both ischion, the shoulder line should be horizontal and parallel to the margin of the desk or table, the vertebral column well erect, the book or paper held at least twelve inches from the eyes. Elbows should not rest on the table: resting both elbows at the same time is less objectionable than one. In writing, the paper should be kept in position with the left hand.

George Sand once gave a very simple and excellent formula for preventing scoliosis and myopia, viz., "*Ecriture droite sur papier droit, corps droit.*" The idea of substituting vertical for inclined handwriting, now so much in vogue, may at first blush seem singular, but undoubtedly the above prescribed posture, with the body in perfect symmetry, erect and parallel with the table, the paper well kept in front, seems to avoid all lateral deformities and myopia. It maintains the head in its normal position, and prevents its tendency to fall nearer and nearer the paper.

We notice less myopia in country schools than in city schools. It is probably due to better hygienic conditions and more regular habits, among which are early rising and early going to bed. For the same reasons myopia is quite rare among primitive races and among our colored population. City children are less disposed to wear spectacles than country

children: they pretend to conceal their infirmity and fatigue their sight by great efforts of accommodation, thereby increasing myopia. The latter is frequently the result of badly printed books. These require special attention. They should be, so far as practicable, of uniform type, not too small, and *interlined*. Through a faulty system of economy, school-books with fine type and *not* interlined are often used. Nothing is more fatiguing to the sight than absence of interlines: all printers agree on that point. Small type interlined is less objectionable than larger type not interlined. For school books each line should have a minimum height of three and one half millimetres.

Badly printed books and faulty attitudes while sitting, together with long hours of study without proper intermissions, and poor light, are the principal causes of myopia. They bring on, especially in young children, in whom the tissues are lax and easily distended, those physical changes in the eye-ball upon which myopia depends.

In so far as the sight is concerned, no inconvenience has been noted from the use of slates, which are rather out of fashion. The disadvantages of the use of slates are the noise made by the slate pencils, unclean hands, and a certain degree of stiffness of fingers, especially when using the pen after the prolonged use of the slate.

CALISTHENICS.

Calisthenics or gymnastics are now introduced in most private institutions. It is a great progress, and in our opinion the practice of such useful hygienic measure should be made compulsory in all our public schools for both boys and girls. It is as important for the latter as for the former. It is not necessary to have complicated and expensive apparatus. A few horizontal bars, a few rings and weights attached to cords and pulleys, will be sufficient. The object of school gymnastics is not to make acrobats of children, but to develop their muscles, to strengthen and equilibrate their nervous system. By its use the child will acquire presence of mind and self-reliance in face of danger.

As far as practicable, gymnastic exercises should take place in the open air, or in a well ventilated and lighted room. Proper instruction should be given in regard to breathing during exercises, and to deportment in walking, sitting, and standing. A useful system of calisthenics without apparatus, for young children, should consist in varied motions of head, trunk, and limbs, in running, jumping, swimming motions, &c. Stick exercises, which are quite varied, as well as ladder exercises, should be added for older children.

A well understood system of gymnastics is one of the most powerful means of diminishing nervous susceptibility, tendency to chlorosis, chorea, phthisis, and scrofulous affections. Such exercises should not be continued beyond a short period—twenty minutes—and should never produce fatigue or exhaustion.

STUDY OF HYGIENE IN SCHOOLS.

A reform of the highest importance, which should be adopted in all our schools, is the teaching to children of elementary notions of hygiene. In several of our states, as far back as 1850, Massachusetts taking the lead, strong efforts have been made to introduce the teaching of hygiene and physiology in the public schools. Unfortunately, with few exceptions, these efforts have not been successful, and there are but very few schools in which hygiene is taught, even in its most elementary form. In fact, strange but true, few of our medical schools possess a chair of hygiene. From recent statistics, we notice that in eleven states only are elementary notions of hygiene given in a few primary or high schools. Amherst college, Mass., is perhaps the only college in which a complete and thorough course of hygiene is given. In my own state, a recent attempt made by our educational and medical societies to obtain from the legislature the enactment of a law requiring the teaching of physiology and hygiene in the public schools has been ignominiously defeated.

Yet hygiene is perhaps the most useful of all sciences. Millions of men, women, and children, all over the world, live in most deplorable hygienic conditions, and ignorance of sanitary laws still prevails to an alarming degree. Sanitary regulations are looked upon as absurd and tyrannical, on account of popular ignorance and prejudice. Is there a more rational means of enlightening the people, of uprooting erroneous ideas and dangerous prejudices, than by generalizing through the public schools simple and correct ideas of hygiene? Public lectures and papers on the subject are not sufficient: they only reach a certain class of people. The teaching of this science in public schools will eventually introduce among the masses true and precise ideas in regard to health, its immense value to individuals as well as to governments, and to the best manner of promoting it, and of avoiding disease and premature death. Through school children those ideas will reach the family, and gradually the whole community. The knowledge of hygiene and sanitary laws should not be the exclusive privilege of scientists. How many evils, physical and moral, might be avoided by a more general diffusion of the principles of hygiene! The latter does not only tend to promote and secure health, but is also one of the great factors of morality and wealth. There can be no true civilization without hygiene. It should be taught in primary schools in a concise, clear, and attractive manner, adapted to the age and intelligence of the child, and limited to elementary and essential principles: in higher schools its study could be made more complete and thorough. This study is of equal importance to both sexes, and should therefore be taught in both boys' and girls' schools. Elementary lectures on anatomy and physiology should always precede. Without some notions of those branches, so important and useful by themselves, the teaching of hygiene, based in a measure upon them, would necessarily

be incomplete and unsatisfactory. The teaching of anatomy, physiology, and hygiene should always, in preference, be entrusted to a medical man. But there exist in our country so many excellent books on the subject, that the teaching of those sciences, in public schools, by persons outside of the medical profession, will be greatly facilitated. Among the books most suitable for children under twelve years of age, we should mention Jarvis's Elements of Physiology and Health, Cutter's First Book of Anatomy, Physiology, and Hygiene, and Foster's Primer. For older and more advanced youths we should recommend Comings, Cutter (New Analytic), Dunglison, and Hutchinson. Dalton, Draper, and Youman's Huxley are excellent for the higher classes and adult students.

SCHOOL MEDICAL INSPECTION.

In order to secure proper school hygiene and to enforce sanitary regulations such as we have suggested, every school, private or public, should be the object of a special sanitary inspection. This inspection should be entrusted to competent and reliable medical men, appointed and paid either by school boards or by city or county authorities. To be effective, this inspection should be complete and made at least twice a month in every school of the locality.

We have seen that schools can exercise bad influences on the health of children. It is therefore necessary that these influences should be detected and corrected as soon as possible. School medical inspectors should advise school-boards and teachers in all questions pertaining to the hygiene of the school-house and scholars. Their surveillance should be limited to a certain fixed number of schools and children. Plans for school-buildings should be submitted to the medical inspector in order to secure all hygienic requirements.

The inspector should pay special and constant attention to the size, sight, and hearing of children, so as to advise intelligently on the proper seat and desk suitable to each child, his position in the school-room in regard to light, distance from black-boards, &c. Near-sighted children, or those who have a tendency to myopia, should naturally be *placed* so as to avoid great efforts of accommodation liable to produce or increase this affection. He should also pay attention to the number of scholars in each class, visiting them during school hours, to their manner of sitting at the desk, to the character or type of books, to the proper temperature and ventilation of the room, &c.

The medical inspector should have an advisory voice in the adoption of a proper programme of studies. He should see that all children are properly vaccinated; that all contagious diseases are carefully excluded from the school until there be no further danger of contamination; that water-closets, back yards, alleys, &c., are properly cleaned and disinfected at frequent intervals.

All notes and observations made by the inspector during his visits should be accurately kept in an appropriate register for the inspection of

the proper authorities. A monthly report should be made by him on the sanitary conditions of the schools and school children in his district, on the diseases occurring among the latter, with particular reference to contagious and infectious diseases.

In some cities of Belgium, which, by the way, possesses a most excellent public school system, the inspector is even authorized to prescribe and furnish, free of charge, to poor and delicate children, such tonics as cod liver oil, iron, etc., as their condition may require. The results obtained from this humane practice have been most satisfactory. Why should not such a philanthropic and enlightened measure be adopted in our own country?

SCHOOL PROGRAMME OF STUDIES.

We now come to the last, and perhaps the most important, part of our subject, viz.: In what consists a proper programme of studies, suitable to the age and intellectual capacity of children, and in conformity with the laws of hygiene?

Every physician, physiologist, or hygienist, who will take the trouble to examine the curriculum of studies generally followed in primary schools, will soon be convinced that it has not been established in accordance with that gradation required by the physiological development of brain. As a rule, the programme of studies is too complicated and comprises too many different subjects, school-hours are too long and too continued without sufficient intermissions, and the method of teaching is too abstract.

Children cannot concentrate for any length of time their attention on one subject. The only way of not fatiguing it is to have short lessons and short explanations. Independently of individual aptitudes, which should be taken into consideration, the number of hours given to study should vary according to the age of scholars and the season of the year. It is evident that the same number of hours devoted to intellectual labor should not be imposed on children seven or eight years old as on those of twelve and fourteen. Yet we often see the same number of hours adopted for the whole school. It is hardly necessary to mention that during the summer months, especially in our Southern country, the intellect is less capable of steady and profitable application than in winter. Heat depresses, whilst cold invigorates, mind and body.

Infancy is the age of *sensations*. Everything for a child is an object of curiosity. The rapid developing of his nervous system is still increased by the thousand objects which strike his senses. His curiosity is wide awake, his muscles always in motion. The impressibility of his cerebrum is such that at times very slight causes will determine delirium and convulsions. Reflex actions are varied, frequent, and rapid, on account of the instantaneousness of his impressions.

One of the first conditions of a correct primary education is to avoid increasing this excessive nervous sensibility by a premature exercise of

the cerebral functions. The prevailing faculty of young children is memory. Later on, reasoning and judgment will develop. During the first period of intellectual life, concrete ideas, objects, can alone captivate the mind, which, at that period, cannot yet grasp abstract notions. Young children have extraordinary facility for languages, which they learn by hearing and speaking, without any idea of grammatical construction. Later on, they will understand rules of grammar and the orthography of words. We have all known some young children who could speak with equal facility three and four languages. This variety of language is an excellent gymnastic exercise for the organs of articulation. It is the means of acquiring perfect flexibility of tongue and a correct and pure pronunciation, which it is impossible to acquire in later years.

We have noticed that children are incapable of long and steady attention. Cerebral lassitude soon supervenes, with impaired perception, diminished memory, headache, vertigo, &c. Hence the necessity of frequently changing the subjects of study, and of short intermissions between classes or lectures. These, when practicable, should be given in different rooms, thus affording to the children an opportunity for motion, or slight exercise and renewal of air. This system is followed with excellent results at the high school of the academical department of the Louisiana University.

This cerebral lassitude in school children has been demonstrated in a striking manner by the interesting experiments of Dr. Sikorsky, of St. Petersburg. He selected a very easy task—*dictation*. Twice a day he dictated to his scholars from the same book, once in the early morning at the opening of the school, and, later on, during the day, after four or five hours of studies. This was repeated in a number of schools. Out of a total of 1,500 dictations of the same character, representing about 40,000 words, examined by him, Dr. Sikorsky found that the afternoon dictations were from 25 to 50 per cent. inferior, in every respect, to those written in the morning. Such a difference is the result of the impairment of cerebral faculties by continuous application.

The number of school hours varies from twenty to thirty per week in England, twenty-eight to thirty-two in Germany, and from forty to forty-eight in France. To these must be added several hours a day for study and exercises at home after school hours. In Belgium they have adopted, we think, the best system. The number of hours varies according to the age of the scholar. Children from six to eight years of age have twenty-five hours' study per week, and those from eight to twelve years have thirty hours' study. This includes gymnastics, drawing, and singing, and needle-work for girls. In Belgium, school regulations have abolished study and exercises at home for young children, and limited them to a few hours for older ones, say from ten to fourteen years of age. These home exercises may have the inconvenience of keeping the child in an atmosphere often impure, in crowded rooms, and on badly constructed seats, thereby favoring awkward and vicious attitudes, &c. On the

other hand, they accustom the child to rely upon his personal efforts, and develop his individuality.

One of the first conditions and most important factors to prevent cerebral lassitude is sleep. Important at all ages, it is particularly so in childhood. The advantages of sleep, "sweet restorer," cannot be overestimated. Leaving out individual differences, due to special idiosyncrasies or constitutions, children between the age of six and ten years should have a sound sleep of at least ten hours; those between ten and fourteen years should sleep nine hours at least. In addition to sleep, recreation, exercises of the body, gymnastics, excursions in the country, etc., should be prescribed in order to maintain the equilibrium between physical and intellectual development.

Recess should last an hour, and should take place in the middle of the classes, thus forming two sessions of studies daily. The teacher should see that children take time to eat their lunch. Some arrangement might be made to furnish them with a hot meal in very cold weather.

Music and drawing, which held a high rank in the education of Greek and Roman children, should be encouraged in our schools. Besides being great accomplishments, they are excellent gymnastic exercises for the ear and eye. These arts are not for the scholar an increase of work, but a source of pleasure. Singing favors the development of lungs and chest: it perfects the voice, cultivates taste, and gives great delicacy to the ear. Reading aloud has also useful results. Drawing forms the taste, develops delicacy of hand and touch, and inspires the love of the beautiful. Both singing and drawing should be begun in an early age.

For the benefit of both scholars and teachers, there should be at least two months' vacation during the hot season of the year, in addition to the usual two days of rest a week. Vacations should be utilized for a few hours' study or reading per week, combined with promenades and excursions. They should be spent in the country whenever practicable.

The main object of education is not simply to teach words and names, but rather ideas and things; to learn how to think and reason, to inculcate in the child's mind just notions, exercise his intelligence on objects which strike his senses, and to enlighten his conscience, while simultaneously striving towards the harmonious development of all his organs.

Religious ideas appertain more properly to church and family than to the school-house. But without entering into questions of dogma, the educator will find occasion to recall to the minds of the students the thought of God, the wonders of creation, and those great moral virtues which are common to all religions and to all civilized nations.

What the child needs above all is good, pure, moral surroundings at home and at school, good examples from parents and teachers. Actions, not words, should teach morality. The reading of heroic deeds, the contemplation of the marvellous spectacle of Nature, should inflame the child's heart with sentiments of pure moral enthusiasm.

The mission of the teacher is a noble one indeed. Whilst engaged in giving his pupils an hygienic training, he should, at the same time, not

neglect their moral education. In every daily occurrence he can intelligently find a theme for a moral lesson. A lecture, a friendly conversation, an excursion in the country, will be as many occasions to him to inculcate in the heart of his pupils good and honorable sentiments, the love of truth and justice, and the ambition of being truly a man.

With your permission, I will now lay before you a programme of studies for school children, which, I think, fulfils at least the principal desiderata of hygiene. It is, with a few alterations, somewhat similar to the programme adopted in Belgium.

TABLEAU OF SCHOOL STUDIES, INDICATING THE NUMBER OF HOURS PER WEEK DEVOTED TO EACH BRANCH OF STUDY.

Branches of Study.	Age, 7 and 8 years.		Age, 9 and 10 years.		Age, 11 and 12 years.	
	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.
Mother tongue	5 hrs.	5 hrs.	9 hrs.	8 hrs.	10 hrs.	9 hrs.
Writing	3	3	3	3	3	3
History and geography	1	1	2	2	2	2
Hygiene and physiology	1	1	2	2	2	2
Natural sciences	1	..	1	1	2	2
Arithmetic	3	2	3	2	3	2
One foreign language	3	3	3	3	3	3
Drawing	1	1	1	1	1	1
Singing	1	1	1	1	1	1
Needle-work		2		2		2
Gymaastics—recreation	5	5	5	5	5	5
Total hours per week five days	24	24	30	30	32	32

Thanking you for your kind attention, I beg leave, gentlemen, to here express the hope that such a programme, or an approximating one, will receive the valuable endorsement of this learned assembly, and will soon be generally adopted in all the public schools of our country.

VIII.

DETERIORATION OF VISION IN SCHOOL CHILDREN.

By S. O. RICHEY, M. D.,

Washington, D. C.

Wherever "two or three are gathered together" a legitimate field is created for investigation by those interested in the moral and physical welfare of their race,—because one may be in health and another diseased, the former, in time, being "made black by handling pitch." If the hygienic arrangements of private houses, barracks, ships, and hospitals are studied, so should be those of theatres, churches, and schools.

Schools are to a great degree protected from the more pronounced contagious diseases, but are they guarded so well as they might be from those that are obscure and less easily detected? Should not each school be ensured all possible safety by a preliminary physical examination in every respect of each child entering it? A certificate of vaccination is demanded of each new comer in many schools. When any of the eruptive fevers are known to exist in a household, no child from that house is allowed to attend until all danger of contagion is believed to be past; but how many there are, especially among the poorer classes, who have some conjunctival affection, and yet attend the schools, associate intimately with those who have not, use the same wash-basin and towel, the same books and pencils! The extent of exposure is not justifiable, and a certificate of health in this particular is as important as in any other.

[1] Reich had an experience due, probably, to exceptional circumstances, but among three hundred and seventy school children in Armenia he found trachoma to exist to the extent of thirty per cent. of the males and twenty per cent. of the females; and there was conjunctival trouble of some character in sixty per cent. of the males and seventy-three per cent. of the females.

Weber suggests that a special physician be appointed with executive authority. This would meet the difficulty at the outset, but it would add to safety to banish wash-basins and towels from the school-room unless each pupil could have his own towel. This last recommendation will not seem uncalled for by those who have seen instances in which the different members of the same family have suffered in a like manner, the source being a single individual and the medium of communication the articles in common use. A low form of granular conjunctivitis, with its train of consequences, trachoma, distortion of the lids, and paunus, is

[1] C. f. A. Oct., 1878, p. 228.

much to be feared. I have never seen it happen in a very young child but once: it is not infrequent after eight years of age. Landesberg states (Archiv. Oph. vol. vj, p. 487) that he has "seldom seen children under five years suffering with granular conjunctivitis." An affection of the eye due to contagion is an accident not attributable to the work of the school-room; but there is another form of trouble which cannot justly be characterized as accidental, because of the constancy with which it prevails among all schools; a shifting or varying in the power of refraction of the eyes, the refraction increasing as the eyes are kept at close work for a long time. This condition of near-sight will in time be as much a curse to civilized people as tuberculosis, uniting as it does the influences of inheritance and acquisition. Germany to-day probably heads the list in the per-centage of myopia to its population, especially among its educated people. That country has also been among the first to appreciate the greatness of the evil, in that it disqualifies in a great measure those who have it for military duty, and therefore for good and efficient citizenship. We, in our neglect or in the inadequacy of the measures adopted, are rivalling her in our results.

Hygiene will be the medicine of the future, and Prophylaxis the patron saint of physician and layman alike. More is to be gained for our race by avoiding now, when it is possible, the sins which will be sure to curse our children, than by all the measures of relief they can reach. The sage contemplates the probabilities of the future, and endeavors to prepare for them. The fool lives in the present, with a selfish regard for himself alone: he drinks his wine to excess, regardless that his offspring must pay to Nature his debts in pain, blindness, general infirmity, and shortened life. A debauch is such, whatever form it may take. No one disputes that excessive guzzling is dissipation. Over-sleep, over-exercise, anything which exceeds the limits nature has fixed, and which does not give to employment the variety that charms and rests, is debilitating, and in so far adds a burden to those who come after us. The overtaxing of any organ makes it tired—a street synonym for drunk. Our moralists inveigh against intoxication by drugs, and yet often encourage that of exhaustion, probably not realizing one to be as bad in its effects as the other. How often does one see this individual at his work, giving testimony against excesses, while himself exhibits the pallor and exhaustion of late hours, hard work, and mental anxiety, the result of which is felt by the child born of his wearied body. He forgets this possibility, and that the Book from which he often gets his inspiration says, "The sins of the fathers shall be visited upon the children, even unto the third and fourth generations." Others, with this example, are inclined to act in the same manner. The children of these individuals begin the work of life handicapped, and their school life at a very early age. They must contend with the offspring of more vigorous parents, and to keep abreast must make greater effort. The working organs are forced to labor beyond that which allows of health, and structure change follows. The bow is never unbent, and it breaks. With longer persistence come greater

changes and increased disqualification, which in turn are handed down to their own children, who then have the burdens transmitted by the father and the grandfather. As living means struggling, there is rarely an opportunity to retrace our footsteps; therefore we must go on, and, moving on, struggle at a greater disadvantage with each succeeding generation, so the end of such a family can be easily predicted, because the evil influence accumulates by geometrical progression.

What is said of a family is true also of a race, except that the causes are in greater variety and intensity, and require a longer time, though the ultimate conclusion must be the same. Let the organ of the body which shows this tendency to depreciation be what it may, the best method of procedure is that of *prevention*. The ills which our bodies suffer were probably not existent at first, but are the outcome of a long series of indulgences by our fathers. We should hold *them* responsible for them, and ourselves accountable for any addition to them which may be manifested in our children. We should not be profligate in study, more than in other things. It is selfish to ourselves to enjoy our patrimony, to spend it all, and then to propagate children who will inherit from us nothing but ills.

Though myopia may not exist in a given instance, the tendency may be inherited; and if any ancestor has had near vision, the precautions against it should be increased. We have here to discuss school work as a probable cause in the production and increase of myopia, and the best means to prevent or lessen it, if possible.

A small proportion of very young children in this country have a high degree of myopia, which is inherited, and these must be excluded from the discussion.

It is not infrequent that the individual begins as a hyperope, the refraction increasing to emmetropia (or normal refraction), and myopia, progressive myopia. The statistics, which are large enough for conclusions, show, in our own and in foreign schools, a gradual increase in the percentage of myopia from the lowest to the highest classes. The persistent use of the eyes at short range upon objects improperly illuminated, or for other reason insufficiently distinct, are believed to be the prominent factors in its production.

Dobrolowsky, in examining the children of the Ural high school, finds myopia infrequent—12 per cent. of the whole. These children live much out of doors, and their high animal spirits no doubt so much diminish their taste for mental work, that they do less of it than many others.

Compare the above with what follows: Durr reports, that among the scholars of the II Lyceum, Hanover, in the lowest class, there are 15 per cent. near sight, and 94 per cent. in the highest, with a mean of 37.7 per cent. In the lowest class there was 81 per cent. of hyperopia, allowing only four per cent. for normal refraction.

Reich found, in a girls' school, 12 per cent. myopia in the lowest class and 53 per cent. in the highest, with an average of 33 per cent.

Dunnert examined 1,133 pupils of Hyde Park schools: 76 per cent. were normal; 12 per cent. of the rest were hyperopic, 8 per cent. myopic, and four per cent. miscellaneous. Only 18 per cent. under ten years had eye-trouble. Among those over fifteen years emmetropia was exceptional. Myopia increased *from 3 per cent. between 5 and 10 years, to 30 per cent. between 15 and 20 years,—ten times.*

[1] Zehender, in his examinations, found nearly 11 per cent. myopic in the sixth or youngest class; in the fifth class, 16 per cent.; fourth, 33¼ per cent.; third, 36⅔ per cent.; in the second, 33⅓ per cent.; and in the first, 41.38 per cent.;—making an average of about 28.6 per cent.

[2] Agnew examined 1,479 students. The ratio of myopia increased with the grade of the school, as in the previous statements reaching an average of 28.8 per cent., nearly corresponding with the report of Zehender. In the district schools 10 per cent. were myopic; in the normal high schools it reached 16 per cent.; in the intermediate school, 14 per cent. In the New York college, Introductory class, the myopia was 29 per cent.; in the Freshman class, 40 per cent.; in the Junior, 56 per cent.; and in the Senior, 37 per cent. At the Polytechnic Institute, Brooklyn, the myopia was 10 per cent. in the academic and 28 per cent. in the collegiate departments.

[1] Cohn, among 9,344 pupils, found the ratio of near vision to increase from the lowest to the highest class. In the sixth class the per-centage was 22; in the fifth, 27; fourth, 36; third, 46; second, 55; and in the first, 58;—making an average of the whole nearly 39 per cent. Among 1,004 myopes, only 28, or 2.7 per cent., had a myopic father or mother.

These figures are not all, but they are sufficient to show the tendency of the eyes doing the necessary work at school to be in the direction of *increased* refraction.

A variety of measures, somewhat conflicting in certain respects, have been suggested for the purpose of preventing or limiting as much as possible the changes in refractive power. [3] Von Reuss claims that in early life the curvature of the cornea is greater, and that it lessens until the seventh year; that after the twelfth year the curvature again increases. The child is sent to school at a very early age (sometimes at four years in Germany, and at five or six years in America), when the tissues are forming, and are more susceptible, because of their pliability, to outside influences than they would be a few years later. His school days cover the period of second dentition, at which time the nutrition of the region of the trigeminus is much disturbed. His eyes are not yet accustomed to forced labor, and every deleterious circumstance makes the most of its opportunity. Constant labor, for from four to six hours a day, at close objects, often in themselves indistinct, with poor or badly regulated illumination and ventilation, enforced tiresome position, an existing slight error of refraction uncorrected, are some of the deleterious circumstances.

[1] *Rostock Gazette*, February, 1880.
[2] *New York Med. Record*, 1877, xij, p. 34.
[3] A. f. O. Bd. xxvij.

Weber, in his report on the higher schools of Darmstadt, recommends that the light should come from a point as high as the heads of the pupils standing up; that the benches should vary in size with that of the pupil; that the work should not be continued for more than forty-five minutes at a time, fifteen minutes being given to exercise; that the teachers be required to see that the work be held fifteen inches from the face; that a special physician be appointed, with authority to enforce these requirements.

[1] Derby suggests that each pupil be tested every six months by the teacher, that a very early knowledge may be had of the condition, in order that he may be treated, and progressive myopia avoided. In my opinion, it will be better if children are not permitted to attend the public schools until the age of second dentition is past, as the rapid progress their more matured minds will make will compensate for the time apparently lost, while they will gain in bodily vigor, and the eyes will be in a more settled condition, structurally and functionally. Objection is made by good[2] authority to all work requiring close vision for young children, giving as a reason that they often leave the kindergartens myopic.

Hasket Derby's views, with regard to the examination of the eyes every six months, are good. The teacher might easily test the distant vision when the child enters the school; then once in six months, and the record would be useful to the child and to school statistics. Becoming a part of the school history, it would show the progress of each individual, as well as the changes from class to class.

The character of the materials used in the school-room has been discussed with some freedom, and with varying conclusions. Malarewsky commended to the Russian Society of Hygiene white letters upon a black background. Cohn prefers the use of white slates, as they do not reflect, and the characters made upon them can be seen farther. Horner advises that ink and paper be substituted for slate and pencil.

The effect of the various methods of writing has been studied, and with not greater unanimity of opinion as to what is important, or the kind of characters and the background which are most conservative. [3] Berlin thinks slanting penmanship is the best method, the angle of the down-stroke with the perpendicular line being about 35° to 40°; that the vertical system requires more muscular exertion of the arm, and forces an oblique position upon the child. Schubert opposes the slanting system of penmanship in schools, because he thinks the difference in distance of the point of fixation of the two eyes might produce anisometropia, squint, loss of binocular vision, and loss of visual power, by causing unequal accommodation.

Manz, of Freiburg, objects to inclined writing, for the reason that it may assist in the causation of myopia by the unnatural attitude of the head. Ellinger thinks the inclined method favors myopia. Königshöfer

[1] *Boston Med. & Surg. Journal*, June, 1880.
[2] Berlin and Rembold,—"The influence of writing on the eyes, and the attitude of children."
[3] Archiv. fur Ophth., vol. xxvij, p. 259, and Ref. to Heidelburg Ophth. Soc., 1882.

does not agree with Berlin. He thinks the direction of the writing is not important; that the laws of the movements of the eyes act very slightly during writing; that the attitude is controlled by the desire for ease of the hand.

It occurs to me that the greatest danger is not to be found in the original work done by the pupil, as in writing on a slate or blackboard, but it exists in the effort he makes to get at the thoughts of others as expressed in print, keeping his eyes fixed upon the same character of type for a long time without relaxation. Much more, in my judgment, is to be feared from the glazed paper, the type, unvarying in size and color, of the school text-books, read by bad light, with the body wearied by the overtaxing incident to our hot-house method of education, which so often *unfits* its victims for success in anything in after life, than from any method of penmanship whatever. Less mental work, more mental and physical recreation, with some variety in the images upon which the eyes are fixed, and in the distance of such images from the eyes, will do much to obstruct the progress of the affection under discussion.

I would suggest, in conclusion, that in the arrangement of our school-books we should endeavor to follow the teaching of Nature, who offers us, instead of plain surfaces and flat objects, broken surfaces and objects differing in color, giving change in form, distance, and color. Instead of a white surface with black letters, or white letters upon a black background, it would save effort on the part of the eye if the school-books were made with raised or embossed letters, varying in color, printed upon an unglazed neutral surface. Thus direction of light would have less importance.

With even surfaces, and single colored flat objects, the ciliary muscle is kept in tonic spasm instead of in healthful play, and, like any other muscle when compelled to move in a fixed direction with measured force and regularity, it becomes less fitted for other efforts, like the man who has been walking over plowed ground for a whole day, who will lift his feet unnecessarily high when walking upon a pavement immediately afterwards. Thus we have myopia acquisita from setting the ciliary muscle for objects at a given near point for a long time, and the recti muscles, being required to maintain great convergence, press upon the bulb and lengthen its antero-posterior diameter. A plain surface gives the idea of fixed distance, and a great extent of snow or sand gives in nature the persistent color, unchanging light—intensity, and unbroken surface, the effects of which are so familiar to us.

IX.

SANITARY SURVEY OF THE SCHOOL-HOUSES IN INDIANA.

By E. S. ELDER, M.D.,

SECRETARY INDIANA STATE BOARD OF HEALTH,

Indianapolis.

Mr. President and Gentlemen of the American Public Health Association: The principal object of this association is "to promote organizations, and devise methods for the practical application of public hygiene." The basal truths of sanitary science are more generally comprehended than practised. The reasons for the prevalence of so much bad hygiene should be attributed more to negligence than to ignorance. What is most needed in sanitary reform is the proper application of sanitary laws. This feature of our work is of greatest interest to health officials. Those of us who are entrusted with the executive departments of boards of health feel deeply the necessity of devising means and methods by which we can bring our work in contact with the people. Sustained, as we are, by the public funds, and amenable to the tax-payers, we must render to them some showing for their money: in short, to sustain ourselves, we must popularize our bureaus. To do this, we must largely rely upon practical efforts. Whilst it is of very great importance to the sanitarian that the cause of obscure forms of disease should be pointed out, or that the relationship existing between certain pathological manifestations should be determined, yet the public impatiently demand a demonstration of the value of practical hygiene in saving life. Theory does not concern the tax-payer. Practical results are the standards by which our work is adjudged. With the dual object of accomplishing much good hygienic work, and of demonstrating the value of our state board of health, one year ago we determined upon a "sanitary survey" of the various school-houses in our state.

From the official report of the state superintendent of public instruction, we learn that there are in Indiana 9,869 public school-houses, valued at over $13,000,000. Of these, 6,898 were frame, 2,763 were brick, 116 were log, and 82 stone. I have reason to believe that the school-houses of Indiana are fully as good hygienically as those of surrounding states; for the public schools of Indiana have long and justly been a pride to her citizens. The magnificent provisions made for the education of her children, the large and ever-accumulating permanent fund of nearly $10,000,000 sacredly dedicated to the common schools, are the admiration of all, and for years past state political conventions

have vied with each other in framing resolutions and planks commendatory of the common-school system of our state. Yet, from personal observation as a health officer and physician, and an experience as pupil and teacher, we were induced to believe that there were many hygienic errors in the location, construction, and condition of the 10,000 school-houses in the state, and among the 700,000 pupils admitted thereto. The following form for a report of a "sanitary survey" of the school-houses throughout the state was prepared, and county health officers were supplied with copies enough for all the school-houses in their respective counties:

In District No. . . , ... *Township*, ... *County, Ind.*

By . . . ., *of* . . . .

Question,—

1. Where located? . . . .; size? . . . . . .; No. of rooms? . . . . . .; material? . . . . .
2. Is the building in good repair? . . . .; height of ceiling? . . . .; No. of children attending? . . . . . .
3. Is it on a public road? . . . .
4. Is it on high, well-drained ground? . . . .
5. What is the size of the yard? . . . .
6. Is it fenced? . . . .
7. Does water stand in ponds in the yard? . . . .
8. Is the house well ventilated? . . . .
9. How? . . . .
10. What are the means for heating? . . . .
11. If stoves are used, are they perfectly *safe*, and in good order? . . . .
12. How many windows? . . . .; size? . . . .
13. Are the windows to the *left* or *right*, *behind* or in *front*, of the pupils? . . . .
14. Are the blackboards placed *between* the windows? . . . .; are the surfaces of the blackboards *dead*, or *glossy?* . . . .
15. What is the source of water supply? . . . . If from wells, are they *kept* clean and in good order? . . . .
16. Is the source of water supply *safe*, and protected from contamination by *cess-pools*, *overflows*, *stables*, *hog-pens*, *privies*, *stock- and barn-yards*, *foul*, *standing*, *or running water?* . . . .
17. Are there any privies? . . . . Are they in *good* order? . . . .
18. Have the privies *vaults?* . . . . How *often* are they *disinfected* or *cleansed?* . . . .
19. Are the pupils *required* to be *vaccinated* before entering the school? . . . .
20. Are pupils from houses where *infectious* or *contagious* diseases are prevailing *excluded* from the schools? . . . .
21. Do you consider the children *overworked?* . . . .
22. Are *all* the doors hung so that they shall swing *outwardly*, as provided by section 2,155, Revised Statutes of Indiana? . . . .
23. What suggestions can you make to render the hygienic condition of the school more favorable?

TO PERSONS MAKING THIS SURVEY.

Please fill *all* the blanks, and answer *all* the questions. It may seem that some of these questions are very simple, and others superfluous; but remember, that when we get returns from *ten thousand school-houses*, much valuable information will be derived, and many practical deductions made. Every question upon this blank is a practical one, and suggested by the observation of intelligent educators, and based upon good reasons. Especial attention is directed to questions 15, 16, 17, 19, 20, and 22. We want a report as soon as possible, as we desire to incorporate a synopsis of the observations in the next annual report of this bureau. I hope that a spirit of generous rivalry and enthusiasm

will induce the persons entrusted with this work to strive to excel in the *promptness*, *correctness*, and completeness of this survey,—remembering that if we can be the means of saving the *life* or *health* of some school child, we shall have accomplished a good mission.

Very truly,

E. S. ELDER, M.D.,
Secretary Indiana State Board of Health.

October 1, 1883.

Answers to eighteen questions by teachers, trustees, superintendents, and others, and per cents. drawn therefrom:

		Per Cent.			Per Cent.
1. Size of yard? . .	½ acre or less.	65	10. Kept clean, in order?	Yes.	89
	½ acre or more.	35		No.	11
2. Is the yard fenced?	Yes.	53	11. Safe from pollution?	Yes.	88
	No.	47		No.	12
3. Water standing in yards?	Yes.	14	12. Are there water-closets?	Yes.	80
	No.	86		No.	20
4. House well ventilated?	Yes.	70	13. Good order? . .	Yes.	60
	No.	30		No.	40
5. Stoves safe, in good order?	Yes.	83	14. Have they vaults?	Yes.	30
	No.	17		No.	70
6. Location of windows?	Right.	97	15. Disinfected or cleansed? . .	Yes.	15
	Left.	97		No.	85
	Front.	6			
	Rear.	17	16. Are pupils vaccinated before entering? . . .	Yes.	42
7. Blackboards between windows? . .	Yes.	30		No.	58
	No.	70			
8. Blackboards dead, or glossy? . . .	Dead.	73	17. Are pupils excluded coming from houses where infectious diseases prevail? . . .	Yes.	88
	Glossy.	27		No.	12
9. Source of water supply, ...	Wells on grounds.	60	18. Do doors swing outwardly? . . .	Yes.	26
	Neighbors.	24		No.	74
	Springs.	11			
	Cistern.	5			
	Ditches. 12				

The county health officers were requested to enlist the interest of the school authorities in making the surveys, and in many cases they were made by the teachers, and in others the township trustees made them. It is with great pleasure that we testify to the prompt and cheerful coöperation of the various county school superintendents, trustees, and teachers. The reports are exceedingly instructive and suggestive. These surveys are but partially completed, but from those already received the opinion

for the necessity for hygienic supervision of the schools is fully confirmed. The vast majority of these houses have been built several years. When located, land was cheap. Nearly all are in localities where land can now be obtained at a low figure. Yet these surveys show that sixty-five per cent. of the houses are upon lots of one half acre or less, and thirty-five per cent. of them upon grounds of more than one half acre. These figures point out a grave error in regard to the size of school grounds. No rural school-house yard should contain less than one acre. The grounds should be large enough to afford room for drainage and ornamentation, and furnish a play-ground for each of the sexes, and to secure a guaranty against the pollution of water-supply, and privacy from neighboring surroundings. These things require at least one acre. Yet our surveys show that nearly seven tenths of the grounds are not that large. School trustees, when determining upon a location for a school-house, should always insist that not less than one acre should be secured for the purpose.

FENCING OF SCHOOL GROUNDS, DRAINAGE, ETC.

All thoughtful persons will at once recognize the necessity for having the school-house yard *fenced.* Without this protection the house is exposed to injury from many causes. The grounds unprotected by a fence are poorly drained, and uncared for. They become muddy, and the walks are destroyed. The water-supply becomes subject to contamination. Water-closets are very liable to be injured or made foul, and the absence of a fence around school grounds gives them a dreary, uncared for appearance, that is apt to make the school-house uninviting and even repulsive to the ardent nature of childhood. Yet our returns prove that forty-seven per cent. of the school-houses are not fenced, and many of the others are in enclosures containing different kinds of buildings. Scarcely any provision has been made for suitable walks. Very few of the yards are properly drained. Underdraining is almost universally wanting, and fourteen per cent. of the yards have ponds of stagnant water during a considerable portion of the time. These are most serious faults. No arrangements are made for drying the clothing of the children, and the result is that many of them are compelled to sit for hours with wet clothing and damp, cold feet.

VENTILATION.

"Better ventilation" and "a supply of pure fresh air" is the almost universal demand from all counties in the state. Kind Providence has surrounded our world with an illimitable ocean of pure air. Why deny it to our school-children? Our reports show that in thirty per cent. of the school-houses no facilities for ventilation are provided, and in the remaining seventy per cent. but few houses are supplied with any other method than than that of lowering or raising the windows. The result is that nearly every school-room in the state is full of foul air. In many of the

houses less than one hundred cubic feet of air is allotted to each pupil, and in some others but seventy feet is supplied. A large number of the houses afford but ten square feet of floor space, and in some it is restricted to six for each pupil. These facts are startling, and are ample causes for very much bad health among the pupils.

HEATING.

Stoves are almost universally used for heating the rooms. In the large towns and cities furnaces are occasionally used. Of the stoves seventeen per cent. were in "bad order," thereby endangering the lives of the children, and often causing the destruction of the school-houses by fire. In very few places were there any arrangements for supplying moisture to the atmosphere. The stoves were usually placed near the centre of the room, and a very general complaint by teachers was that the pupils nearest the stove suffered from excessive heat, whilst those remote were cold. But very few instances were there where any provision was made for warming the air before it was introduced into the room.

LOCATION OF WINDOWS, SHADES, ETC.

In 97 per cent. of the houses the windows are situated upon the right as well as upon the left of the pupils, and in 6 per cent. the windows are directly in front of the pupils, while only in 17 per cent. is it admitted from the rear. When we remember that the rays of light should, if possible, be admitted from the rear and left of the pupils, the gross opthalmic errors in this connection will at once become apparent. Again, in scarcely any houses are there suitable shades or curtains to the windows. The light is allowed to fall directly upon the persons, faces, books, slates, and papers of the pupils.

BLACKBOARDS.

The location and condition of the blackboards are additional sources of injury to the eyesight of the pupils. In no less than 30 per cent. of the houses these blackboards are placed between the windows, and in 27 per cent. of them their surfaces are glossy. These two errors must necessarily cause great injury to the vision among the three quarters of a million pupils of the common schools of Indiana. This branch of the subject of school hygiene has not been so obtrusively pushed upon public notice as the gravity of the evil demands.

WATER SUPPLY, ETC.

Pure cool water is a boon that school-children are too often denied. In our state we find that there are wells at only 60 per cent. of the school-houses, and of those 12 per cent. have never been cleaned, and are polluted. Twenty-four per cent. of the houses depend for water upon the

neighbors' wells; 10 per cent. of the houses depend upon springs near the houses; 5 per cent. of the houses had cisterns for their source of supply; while twelve houses depend upon an open ditch for their potable water. Numerous instances were reported where dead animals were found in the wells, and some of them were in close proximity to barnyards, cess-pools, and other sources of contamination, while six of the wells evidently were polluted by the drainage from grave-yards immediately adjoining.

WATER-CLOSETS.

In this advanced stage of civilization, it may seem like supererogation to say that every schoool-house should have suitable water-closets for each of the sexes. These should be properly constructed, with good vaults, should be kept clean and disinfected. Yet these sanitary surveys show that 20 per cent. of the school-houses have no water-closets, and that where they have them, 40 per cent. of them are in bad repair; that 70 per cent. of these closets have no vaults, and that 85 per cent. of the vaults were never cleaned or disinfected. Many of the closets were filthy, and unfit for use. In several of the vaults there were dead animals,—a sheep in one, several dogs, cats, etc., in others. It is a standing reproach upon our civilization, that school-children should be compelled to attend to the calls of nature under the most painful embarrassment of having no more provision made for privacy than is given the brutes of the field; or that a pure, neat, clean, innocent girl should have to go into a revolting, filthy, nauseous water-closet, or sacrifice her modesty, or neglect these duties to the peril of her health. We cannot too strongly condemn such a condition of affairs as alike detrimental to health, morals, and delicacy. A few pounds of sulphate of iron, and a few minutes' work semi-weekly, would keep the water-closets of school-houses from becoming a revolting nuisance or a source of ill-health.

VACCINATION.

The reasons for requiring the vaccination of all persons before being admitted to the school-room are so obvious, that their correctness is usually granted. Yet our surveys demonstrate that in fifty-eight per cent. of the schools of the state a vaccination of the pupils has not been required. The consequence is, that in case small-pox should break out in those neighborhoods the schools would have to be closed. No child should be allowed to enter school until it has been successfully vaccinated. This is now acknowledged in all cities and towns, and they have generally enforced it by municipal ordinance. In the city of Indianapolis, although small-pox had ninety-five distinct centres of infection in the last two years, yet not a school-child has suffered. Previous vaccination has been demanded of all children admitted to her schools. The State Board of Health has adopted the following rule upon that subject:—

RULE 3. No persons, until after they have been successfully vaccinated,

shall be admitted into any *public* or *private* school or institution of learning within this state, either in the capacity of teacher or pupil.

DANGEROUS DISEASES.

School-children afflicted with loathsome or infectious diseases should be excluded from the schools, and when diphtheria, scarlet fever, or small-pox is prevailing in a household, no one from that place should be allowed to attend school. Very many instances are recorded where a disregard of this precept resulted in innocent parties' becoming infected with fatal sickness. Our surveys show that in twelve per cent. of the schools none of these precautions against infectious diseases are adopted. The following rules have been adopted by the State Board of Health in regard to this subject:—

RULE 1. No person afflicted with any contagious or infectious disease dangerous to public health, shall be admitted into any public or private school within the jurisdiction of this board.

RULE 2. No parent, guardian, tutor, or other person having charge or control of any child or children, shall allow or permit any such child or children to go from any house or building infected with scarlet fever, diphtheria, cholera, small-pox, or other contagious or infectious diseases dangerous to public health, to attend any public or private school within the jurisdiction of this board.

RULE 9. No parent, guardian, tutor, or other person within the jurisdiction of this board, having charge or control of any child or children, shall allow or permit any such child or children to go from any house or building infected with scarlet fever, diphtheria, cholera, small-pox, or other contagious or infectious diseases, to attend any public school, church, or any place of amusement, or to travel in any street car or public vehicle.

RULE 10. No person within the jurisdiction of this board shall be allowed or permitted to go from any house or building infected with scarlet fever, diphtheria, cholera, small-pox, or other contagious or infectious diseases dangerous to public health, to attend any public school, church, or any place of amusement, or to travel in any street car or public vehicle.

In eighteen counties in Indiana, where small-pox prevailed within the year 1883–'4, so well were the rules enforced, that in but one county did any school-child die from the malady; and the health officials in that county wrote that this was because "it was not successfully vaccinated."

SWINGING OF DOORS.

The statutes of our state require that "The doors in school-houses, seminaries, colleges, etc., shall be so hung that the same shall swing outwardly." These surveys prove that in seventy-four per cent. of the school-houses the law is disregarded. In small, one-story houses the

necessity for complying with the law is not great, but in all buildings of more than one story or one room it should be complied with by all means.

REMARKS.

Perhaps it will be interesting to give a few extracts from the "remarks" of those making these surveys.

One says, "A description of one country school-house applies to all: a flat box, with its four corners resting on stones, a roof, six windows, a flue for smoke, and door to go in and out of, all placed in a corner of ground too poor for farming; often unfenced and undrained, wanting in anything ornamental or tasty to please the eye." Number two says, "I have ordered the well at No. 7 abandoned at once, and advised the removal of the house on account of its proximity to a cemetery. The graves are within a few feet of the house, and any well that could be dug in the yard could not be farther than one hundred feet from the graves. The school-yard is between the cemetery and a creek, and the water would naturally flow from the cemetery under the school-yard to the creek, and through sand and gravel at that. So I think it impossible to have a well to supply the school with drinking-water uncontaminated in that vicinity." A conclusion which I heartily indorse. Another health officer says of a school-house, "I recommend that the well be cleaned, that new vaults be dug, and located in the rear corners of the school-yard, farther from the well; also that the back part of the yard be ditched where the water now stands in ponds." A teacher reports, "One out-house in terrible order, about six or eight feet from the window. It should be moved." Another one writes, "We need not exactly more ventilation, but better. We get plenty of fresh air, but at an expense of innumerable draughts. The pupils are very much troubled with colds, engendering more serious disease." Still another writes, "Our house is not underpinned: it is a difficult matter to keep the proper temperature on this account." An accomplished teacher writes, "Our water supply is from a well. At a low stage the water does does not taste well. There are two large grave-yards within a few hundred yards, which I have viewed suspiciously. I do not know that they influence the water in the well. The location is gloomy, and the house and surroundings in bad repair." A lady teacher writes, "We have no water-closets. If we only had *one*, it would save many little feet from the wet and cold in running to the woods." Another one says, "I would suggest that we have a new stove, that the leaky roof be repaired, that the house be replastered, that the holes in the floor be stopped, that the broken windows be repaired, that we have a water-closet built and a well dug, that the yard be fenced and drained," etc. There is evidently a great need of something to be done. Another says, "O if we only had gravel-walks, so that the children could clean the mud off their feet, which get so wet and dirty." We would suggest here that it is slow work trying to advance pupils until they are raised out of the dirt and filth. The principal of a school in a flourishing town in the

western part of the state writes,—"House (fifty by sixty), four rooms; no well; get our water where we can; no water-closets. Doors all open inwardly. I think we ought to have a vault dug and a good well. The first room up-stairs is thirty by fifty; ceiling, eleven feet; has ninety-eight pupils; three windows at each end of room. The second up-stairs room is twenty-five by thirty, eleven feet ceiling, and contains sixty-eight pupils; three windows at each end. Third up-stairs room twelve by twenty, eleven feet ceiling, two windows on west side, has thirty-eight pupils, jams them in. The primary room, twenty-five by thirty, twelve and a half foot ceiling, sixty-four pupils, three windows on south side, black-boards between the windows and doors, some having glossy surfaces. Our trustee is a thorough M. D., so that our school-houses are good enough to please the doctors' pocket-books."

A few weeks ago the statement was made at a meeting of the Medico-Legal Society of the city of New York, that in that city alone "three thousand school children annually lost their lives because of the foul and poisonous air which they have been compelled to breathe." A sanitary inspection of the twenty-eight school-houses of the city of Indianapolis revealed hygienic faults in sixteen of them, and a polluted water supply at ten of them. Analyses by a chemist selected by the board of education demonstrated that the water from a large majority of the wells examined was grossly polluted. During the survey a member of the board of education, a physician and philanthropist, entered a basement room, filled with little children, in one of the largest school buildings in the city. The air was so revolting that he remarked, "This room smells worse than a woodpecker's nest." He instantly ordered the children removed to another room above ground.

If these conditions exist in New York and Indianapolis, under the most approved methods of conducting schools, what must be the condition in districts where no special attention has been given to school hygiene?

The education of people in hygiene cannot be accomplished by the present literary course. Take, for instance, Monroe county, lying in the shadow of the State University, which institution was chartered and erected in 1828—fifty-six years ago. The sanitary surveys of the school-house in that county reveal the fact that 64 per cent. of the yards are not fenced, thirty per cent. of the houses are not well ventilated, 18 per cent. of the stoves are unsafe and in bad repair, 100 per cent. of the houses wrongly lighted, 66 of them have blackboards in wrong places, 45 per cent. of the blackboards have glossy surfaces, 75 per cent. get their water-supply from springs, 64 per cent. of these springs are not fenced or protected from overflows or impurities, 61 per cent. have no privies, 17 per cent. of these privies are in bad order, 42 per cent. of the privies have no vaults, 41 per cent. are never disinfected, 16 per cent. of instances where children are not excluded, coming from families where infectious or contagious diseases are prevailing. From Monroe county one school-house survey reads as follows:

"Our house is unfenced. Stove in bad order. Our source of water-supply is an unfenced spring, which is a very poor excuse for water-supply, as it is situated in an open pasture where hogs, cattle, geese, and other animals congregate and leave their offal. I am satisfied that a great number of school children here have suffered from the want of good, pure water."

Another from this county says, "Our house is in an open field, a pond of stock-water within fifty feet of the door. There are numerous cracks in the floor and around the door, and the plastering is off in several places. The house is high off the ground except at one end. It has never been underpinned. The shelter thus afforded has evidently been utilized for many years past as a lodging-place for numerous hogs that inhabit the woods, lanes, and by-ways adjacent. Our source of water-supply is a small creek, into which, a short distance above from whence the water is dipped up for the school, a barn-yard drains, and about one eighth of a mile above is a cemetery, a part of which is evidently drained by this creek."

Such a condition of affairs, in a county which for more than half a century has had the State University in it to enlighten the people, at once demonstrates the fact that the hand of some sanitary officer, clothed and strengthened by the authority of the law, is demanded to redress these gross wrongs upon the school-children of our state.

These extracts are but a fair sample of the statements received with the reports of the sanitary surveys, and they conclusively demonstrate the necessity of hygienic supervision of public schools. Two weeks after the blanks for the surveys were sent out, the following order was sent to all the county health officers, viz.:

"Dear Doctor: Please examine carefully the school-house sanitary surveys as fast as they are returned to you, and when hygienic faults are found, order them corrected at once."

The result of this survey has been very gratifying: they have aroused a general interest in school hygiene all over the state. Newspapers, educational journals, school officials, physicians, teachers, and many others, have spoken of the work encouragingly. Many errors have been corrected, and the schools of our state are in a better hygienic condition than ever before.

At the beginning of the present school year the following order was issued, and served upon every township and town school trustees in the state:

Office of Indiana State Board of Health,
Indianapolis, September 13th, 1884.

To County Health Officers:—

The results of the sanitary surveys of the school-houses of Indiana demonstrate the fact that very many hygienic faults exist in connection with them and their surroundings. Many of these errors have been corrected, and school authorities have cheerfully complied with the requests of health officers in this regard; but a new school year is about to be ushered in. Many of the houses were not occupied during the summer months,

and we are satisfied that their surroundings and conditions need sanitary supervision. It is very desirable, therefore, that township and town trustees, and such other school authorities as are in your county, shall place in a good sanitary condition the various school-houses under their control. The following points require especial attention:

1. Purity of the water supply.
2. Ventilation of the school-rooms.
3. Repairing of the buildings.
4. Drainage of the yard and grounds.
5. Providing suitable water-closets, and keeping them in good condition.
6. Heating of the school-rooms.
7. Overcrowding of rooms.
8. Location and condition of the blackboards.
9. Lighting of the rooms.
10. Seating of the rooms.

To insure a favorable hygienic condition for the schools, the following essentials are demanded:

A. To clean out all sources of water supply, and place them in good condition; and where houses have no supply of their own, to at once furnish one.

B. In the absence of a better system, to prepare the windows and transoms so that ventilation can be had without causing draughts of cold air to come in contact with the pupils.

C. To place the buildings in good repair, with tight floors, good roofs, and underpinnings.

D. To see that the yard and grounds do not admit of standing water, and to prepare gravel or board walks to keep the children's feet out of the mud.

E. Suitable water-closets for each of the sexes should be provided with every school-house. They should be situated far enough away from the house to secure privacy, and not be a nuisance. They should be kept in good repair, cleaned, and disinfected at least twice a month.

F. The rooms should be so warmed that all may be kept comfortable; stoves and furnaces safe, and in good order.

G. The rooms should not be overcrowded. Not less than fourteen square feet of floor space, and two hundred and fifteen cubic feet of breathing space, should be allowed each pupil.

H. Blackboards should not be placed between the windows, and the surfaces of the boards should be a *dead black*, not *glossy*.

I. The light should, if possible, be admitted from the rear of the pupil,—*never* from the front.

J. Desks and seats of different heights should be furnished, to suit the sizes and ages of pupils.

In order to insure immediate action, there is attached to this a blank order, which you will please fill up, and issue to the proper authorities, and cause its enforcement.

By order of the board.

E. S. ELDER, M. D.,
Secretary and Executive Officer.

. . . ., Indiana, Sept. . . . . . ., 1884.

To . . . .

Trustee of . . . ., ... County, Ind.

You will please cause the foregoing order of the Indiana State Board of Health to be rigidly enforced in your jurisdiction.

By order of the . . . . County Board of Health.

. . . ., M. D..
Secretary and Executive Officer.

As before stated, we have every reason to believe that the public schools of Indiana will compare favorably with those in our sister states, and, dark as is the picture presented by these returns, to display its counterpart it is only necessary that some official hand shall raise the curtain by causing a similar survey to be made in any of the adjoining commonwealths. In our opinion, no more inviting field for the work of the sanitarian presents itself than the common schools of our country, and the health officials who attack these abuses and correct these evils will secure the approbation of the mass of the people; for we believe that the patrons of the schools only need to have their attention called to these matters to insure their hearty coöperation in abating the wrongs. People, after all, love their children, and only need to see these evils as we see them in order to appreciate the harmfulness of them. These are a few suggestions which force themselves upon us, and we think they deserve careful consideration. If they seem plain, simple, and commonplace, remember that in very many places they have been unheeded; in fact, we feel safe in saying that they are very generally unheeded.

Boards of health should prosecute this line of work, and continually strive to induce a reform in, and the adoption of a higher standard of, practical school hygiene. By so doing, we feel that many promising children will be saved from disease and death, and many more rendered comfortable and happy by our efforts. We recognize the fact that these considerations are among the simple and primary ones. The course of study, the length of school sessions, the confinement of young children, the posture and manner of seating, the recreation, the practice of gymnastics, the study and practice of calisthenics, music, etc., and a host of other questions obtrude themselves; but we should endeavor to remedy the grossest evils first, trusting to an advancing civilization and a "new era" in school hygiene to cure the lesser.

X.

DISEASE GERMS.

BY GEORGE M. STERNBERG, M.D., F.R.M.S.
MAJOR AND SURGEON, U.S.A.

It is but a few years since "disease germs" were hypothetical things, in regard to the origin, nature, form, and *modus operandi* of which we possessed only vague and uncertain notions.

In this pre-scientific period of etiological inquiry, a favorite idea with those who assumed the existence of disease germs on theoretical grounds was, that they are living particles detached from the diseased organism, capable, perhaps, in some instances, of self-multiplication external to the body, and having the power, when introduced into the body of a susceptible individual, of inducing morbid phenomena identical with those which, in a preceding case, were the cause of their origin; in other words, that they are both the cause and the result of the morbid phenomena which characterize the specific infectious diseases.

No experimental evidence has thus far been adduced in favor of this conception of disease germs, which is evidently unphilosophical, and is unsupported by observation or analogy. The only detached living particles known to science which are thrown off from the bodies of plants and animals, and which are capable of subsequent development, are the reproductive elements, the function of which is to preserve the species, and not to destroy it; and observation teaches that, as a general law, disease is due to agents introduced from without, whereas the view above referred to would necessitate a belief in the intrinsic origin of the specific infectious diseases: for there could be no disease germs detached if there were no diseased organism to throw them off.

But the progress of science has made us acquainted with disease germs of another kind, which, being *vegetable* parasites, must in the first instance have been of extrinsic origin, even if at present they have, in certain cases, no other habitat than within the body of the animal in which they produce specific morbid symptoms. Thus, if it be demonstrated—a very difficult matter, by the way—that the tubercle bacillus is found only in the tubercular products which result from its invasion of the bodies of man and the susceptible lower animals, it will be none the less improbable that this has always been the case. We must admit that this bacillus existed in nature before there was any tuberculosis, or we are forced to one of two conclusions: either the disease tuberculosis at one time occurred independently of the bacillus, or the parasite was created as it now is, and implanted in the bodies of animals especially to produce this

disease. The second alternative involves the acceptance of a theological conception, which cannot be discussed from a scientific standpoint. It is evidently opposed to the scientific conception, which has forced itself upon careful students of nature in all parts of the world, and which is expressed in the word *evolution*.

If at any time in the past the disease tuberculosis existed independently of the tubercle bacillus, or of any other micro-organism, then we must deny that this parasite has any etiological import, or must at least assign it a secondary *rôle*, viz., that of carrying a non-living tubercle virus from a diseased organism, and implanting it in a new soil. In this case the infectious character of the disease would depend upon the living parasite; but inasmuch as the disease must at some time have originated independently of the parasite, we could scarcely deny the possibility of its intrinsic origin at the present day. There is much to be said in favor of this view of the etiology of the infectious diseases, but it is opposed by the experimental evidence, which shows that "pure cultures" of known disease germs are as potent in producing the specific morbid phenomena as is material derived directly from the diseased organism.

In the case of anthrax there can be no doubt that this is true, and that living anthrax spores may produce the most virulent form of the disease, independently of any non-living material derived from a preceding case. The experiments of Koch seem to have established the same as regards the tubercle bacillus, pure cultures of which are said to produce tuberculosis in rabbits and in guinea pigs as certainly and as promptly as do inoculations with sputum or other material derived directly from the diseased organism. These experiments have been repeated by Watson Cheyne, of London, with the same result.

I cannot doubt that these gentlemen have obtained the results reported by them from inoculations with pure cultures, in the sense that no other micro-organism was present in these cultures. The only possible question is, whether these cultures were pure in the sense that they did not contain any remnant of a non-living tubercle virus. How many successive cultures must be made in order to insure this result we cannot definitely determine, but evidently more are required when cultivation is conducted upon the surface of a solid culture medium, than in fluid cultures in which a considerable amount of fluid serves to dilute the non-living material which, in the diseased organism, is associated with the living microbe. There can be no question, however, that a non-living poison, which originated in the diseased organism independently of the parasite, would in the end be excluded by the method of successive cultures, whether these are made in a fluid or upon a solid substratum. On the other hand, a virus produced by the parasite as a result of its normal physiological processes would be present with it in each successive culture.

It may well be that all of the different pathogenic bacteria produce special poisons, to which their specific action is due; but a poison produced by the parasite itself, whether grown in an animal body or in a culture fluid, is evidently secondary as an etiological agent, although it

may be an essential factor in giving the parasite pathogenic power. We may suppose that such a poison, secreted by the invading micro-organism, prepares the soil for its future growth, just as the abnormal growths upon various plants known as galls are supposed to be produced by the irritant action of some poisonous liquid introduced by the sting of an insect, which at the same time deposits an egg. A virus, on the other hand, which was produced in the diseased organism independently of any parasite, but which furnished the soil suitable for the development of a particular microbe, would be the essential etiological agent in the production of the morbid phenomena, and the parasite, if not a mere epi-phenomenon without etiological import, would at least be only a secondary factor, capable, perhaps, of doing harm by inducing changes in morbid products, as, for example, the cheesy degeneration of tubercle nodules, and of transporting the virus to new localities, and thus giving the disease an infectious character.

As heretofore remarked, this hypothesis must give way before the evidence furnished by pure cultures; and it must be admitted that the experiments of Koch leave very little ground for believing that it is true as regards tuberculosis. It is not safe yet to generalize, however, and it does not follow that it is not true for small-pox and other diseases in which pure cultures of the parasite present in diseased tissues have not been proved to be potent in the perpetuation of the morbid phenomena in other individuals.

We need a non-living poison or virus in order to explain the action of the tubercle bacillus, for I do not feel prepared to admit that the effects which follow inoculations with pure cultures of this microbe are due to mechanical irritation alone. I have recently repeated the experiments of Formad, of Philadelphia, in which he claims to produce tuberculosis by inoculations with finely-powdered inorganic material suspended in water. My experiments have satisfied me that when the material is thoroughly sterilized, and no tubercle bacilli are introduced at the same time, tuberculosis does not result from such inoculations. We know that the lungs of man are very commonly loaded with particles of carbon, and that these angular particles, which are much larger than the tubercle bacillus, do not give rise to the development of miliary nodules. Therefore, I say, we need something more than the bacillus to account for the formation of these nodules in which the parasite finds a suitable soil for its development.

If tuberculosis was originally of extrinsic origin, and is to-day produced by "pure cultures" of the bacillus, there can be no question that this something else is excreted by the parasite, and is consequently ever present with it, ready to produce its specific effect when in contact with susceptible animal tissues. Not all vegetable tissues react in the same way to the sting of the various species of gall-insects, and in like manner we have differences in susceptibility to disease poisons among animals of different species, and among different individuals of the same species. The supposition that the different pathogenic organisms give off different

kinds of poisonous products as a result of their normal but severally distinct physiological processes, is sustained by what is known of the action of non-pathogenic organisms of the same class in various processes of fermentation and putrefaction, and by the facts which relate to the influence of protective inoculations and the non-recurrence of the specific infectious diseases in the same individual. I have elsewhere discussed this subject (see my work on "Bacteria," p. 246), and cannot at present give my reasons for believing that insusceptibility results from acquired tolerance to the poisonous products evolved by pathogenic organisms, rather than to a change in the system which has rendered the soil unsuited to their development.

The question whether pathogenic bacteria are distinct species having permanent physiological characters upon which their pathogenic power depends, or whether they are varieties of common and usually harmless species which acquire this power temporarily as a result of special conditions relating to their environment, is one of the greatest importance, and one which is at present prominent in the minds of the leading investigators in this field.

Buchner's claim that the anthrax bacillus is simply a variety of the common hay bacillus, and that one may be transformed into the other by special methods of cultivation, has, upon fuller investigation by Koch, Klein, and others, been shown to be without foundation. We now recognize not only that these species have distinct physiological characters of a permanent kind, but also that during certain stages of their development they differ morphologically. Indeed, the specific distinction is sufficiently well marked by morphological characters alone. But it does not follow that there is nowhere in nature a non-pathogenic variety of the anthrax bacillus from which the pathogenic variety known to us has been derived. So, too, in the case of the tubercle bacillus, we are not acquainted with any harmless bacillus having exactly the same form and color reactions, and among known species the bacillus of leprosy is the only one which very closely resembles it. But it must be remembered that we have only just commenced the study of this extensive class of micro-organisms, and that thus far it is the pathogenic species which have received the greatest attention. When we come to know more of the bacterial flora of the exterior world, we may find that all of the species which invade the bodies of animals as harmful parasites are represented by harmless species, which cannot be distinguished from them except by the test of inoculating susceptible animals.

In the case of an organism like the anthrax bacillus, which grows readily in a variety of culture fluids, and within comparatively wide temperature limits, it seems altogether probable that the conditions necessary for its growth may be found external to the bodies of animals, and outside of our laboratories. But it would be an unwarranted assumption to suppose that its continuous development in this way must necessarily modify its pathogenic power. For this is retained in full force through any number of successive generations in laboratory experiments, except when the cult-

ures are subjected to the special conditions which have been shown to modify this power, and which, following Pasteur, we speak of as effecting an "attenuation of virulence." The question is, whether a similar attenuation may not be effected by natural conditions, and whether the attenuation may not be carried to the vanishing point. This is possible, but we have at present no evidence that it is true.

In the case of the tubercle bacillus, it has been shown that the conditions of development are so restricted as to soil and temperature required, that it may be doubted whether these conditions are ever found in nature. It grows slowly upon blood-serum prepared by Koch's method, and not at all unless the temperature is very carefully regulated to about 38° C. Evidently if in a tropical country the temperature were sufficiently elevated and uniform to insure its development, the proper pabulum might be wanting; or if this were present, other bacteria which multiply more rapidly would most certainly take possession of it, in the absence of artificial precautions for their exclusion, before the tubercle bacillus had fairly commenced to grow. It seems probable, therefore, that this bacillus, as we know it, has no external habitat, and that it depends for its existence upon the conditions which it finds within the bodies of animals subject to the disease tuberculosis.

But, for reasons already given, we are forced to the conclusion that at some time in the past this bacillus had an external habitat; else we must concede that the disease tuberculosis was originally of intrinsic origin, and must relegate Koch's bacillus to a secondary place in its etiology. We have, among the higher animal parasites, a certain number which have the power to shift for themselves, and to bring up a family independently of the host upon which they habitually depend for their sustenance. Others depend entirely upon their host, and students of biology are familiar with the singular modifications which many of these have undergone to fit them for their parasitic existence, and which make it impossible for them to exist independently of the animal which they infest. No doubt is any longer entertained with regard to the fact that the structural anomalies exhibited by these parasites are due to modifications which have been effected gradually, and that useless organs have disappeared and useful ones have attained a special development under the influence of conditions relating to the environment of the parasite, and in accordance with the laws of natural selection.

It is probable that the minute vegetable parasites which we know as "disease germs" have in like manner undergone various modifications, if not in form, at least in their physiological characters; and it may be that some of them have thus lost the power of independent existence under natural conditions. Others may find the conditions essential to their development, both within and without the bodies of animals. Indeed, we know that such is the fact as regards several species which have been shown by laboratory experiments to have the power of inducing infectious and fatal forms of disease in certain animals, and which, nevertheless, exist, widely distributed in nature. Koch's bacillus of induced

septicæmia in the mouse, the bacillus of malignant œdema, which is much larger, and closely resembles the anthrax bacillus, and the micrococcus of induced septicæmia in rabbits, which I have especially studied, are all disease germs of this kind. Their pathogenic power is not a temporary character, but is limited to certain species of animals in the bodies of which they find conditions favorable for their development; and, so far as we know, the infectious diseases which they induce do not arise spontaneously in these animals.

Other disease germs, such as the micrococcus of fowl cholera and that of swine plague, are only known to us because they induce these forms of disease; and the question whether they exist in nature, independently of the animals which they infest, has not been definitely settled. If they do, we should expect to hear of the development of these diseases independently of infection directly traceable to a similarly diseased animal. I am not sufficiently familiar with the evidence to say whether it supports this view of the case or not. But as regards the germ of typhoid fever, which we can scarcely fail to believe in, although there has been no satisfactory scientific demonstration of its existence, and as regards the cholera bacillus—or spirillum—of Koch, which, there is good reason to believe, bears an essential etiological relation to the Asiatic pestilence, there seems to be ample evidence of power of multiplication external to and independently of the human organism. We have known for some time that the germs of these diseases are sown in the discharges of those suffering from them; that certain conditions as to organic pabulum and temperature are necessary for the germination and rapid multiplication of this kind of seed; and that the evidence of such germination and multiplication is found in an abundant harvest of fresh victims.

But do these germs in their external development undergo modifications which cause them to lose or to gain in pathogenic power, and are they ever harmless organisms, which may be introduced into the human intestine with impunity? The wide difference in the malignancy of different epidemics, and the fact that during the same epidemic the disease may at first assume a mild form, and subsequently develop a most malignant character, indicates that the germ, if it be in truth the essential factor in the production of the disease, must undergo modifications of its pathogenic power. And once having admitted the possibility of such modifications, it is hard to place a limit upon them.

There are two infectious diseases of man, one of which has been lately proved to be due to an invasion of the affected tissues by micro-organisms, and the other of which I can scarcely doubt has a similar etiology, which seem to me strongly to support the view that bacteria which are ordinarily harmless may, as a result of special conditions relating to their environment, acquire pathogenic power. These diseases are erysipelas and hospital gangrene. It seems to me beyond question that these diseases may, under certain circumstances, originate *de novo*, that is, without direct or indirect infection from a preceding case. And hospital gangrene especially is so rare a disease that we can hardly suppose that the out-

breaks which occasionally occur at widely remote localities are necessarily connected with preceding cases, although these diseases are known to be highly infectious, and to cling to infected hospital wards with great tenacity.

I have in mind an outbreak of hospital gangrene which occurred under such circumstances as seem to me to justify the belief that the epidemic was of local origin. In the summer of 1862 a large number of sick and wounded men from the army of the Potomac were placed upon a transport vessel at Harrison's Landing, Va., and brought directly to Portsmouth Grove, R. I. This location possessed great natural advantages, both from a sanitary and from an æsthetic point of view, and, before the arrival of this ship-load of sick and wounded soldiers, enjoyed a high reputation for salubrity. A quiet summer hotel, looking out upon the waters of Narraganset bay, formed the nucleus of the general hospital, which was quickly built. Until this was completed, the patients were cared for in hospital tents. Soon after the completion of the hospital building, I was ordered to Portsmouth Grove, and upon my arrival there was placed in charge of the surgical wards. These were detached frame buildings, made of new lumber, and constructed upon the plan which had been adopted for our barrack hospitals, and which is generally conceded to have been excellent. My wards were full of cases of suppurating gunshot wounds. This was before the days of carbolic acid, at a time when we had no positive knowledge of disease germs, and before we had learned to look upon a sponge as an abomination not to be admitted to a surgical ward. My patients were treated in the usual manner, with cold-water dressings to recent wounds, and frequently renewed absorbent dressings, and ablutions with warm water, when suppuration was fairly established and there was no inflammation. I dare say the saucers for giving off chlorine gas, which were in those days supposed to be an important element in maintaining the purity of the atmosphere in the wards of our military hospitals, were duly arranged beneath the several beds. Whether they were or were not, a matter in which my memory does not now serve me, is of small importance; for we now know that it is impossible to disinfect the air of an occupied apartment, and that the presence of chlorine gas, or of carbolic acid in respirable amounts, has no terrors for disease germs.

Up to a certain point my patients continued to do well; but after a time I recognized the presence of some malign influence in the wards, which was counteracting the *vis medicatrix naturæ* upon which I relied for the cure of these gunshot wounds, and which caused wounds that had previously been healing kindly to assume an angry look, and to discharge an undue amount of unhealthy pus. Very soon the condition of some of these suppurating wounds became still more alarming. Instead of a simple arrest of the healing process and an unhealthy discharge, I had to deal with a rapidly extending necrosis of the tissues. The most trifling wounds in robust young men, which were cicatrizing in a most satisfactory manner, as well as those more serious injuries which had necessarily

given rise to protracted suppuration and depression of the vital powers, would suddenly commence to extend by sloughing, and a superficial wound the size of a twenty-five cent piece was liable within two or three days to become an ugly and deep sloughing ulcer the size of my hand, or larger. In a word, I had to deal with that dread disease, hospital gangrene. I can hardly doubt that this rapidly developed necrosis of tissue, extending from the wound as a centre, was due to invasion by some micro-organism; and I infer that the pathogenic power exhibited by this hypothetical organism was developed in my wards as a result of exceptional conditions of environment by some omnipresent and usually harmless microbe. Otherwise, how is it that solitary cases of suppurating wounds scattered far and wide over the country never become affected with this disease, which only occurs where numbers of wounded men are massed in hospitals? That the disease was a local one, due to some noxious agent which invaded the wound, and which was transmissible from one to another, and was not due simply to a depressed condition of the general health of those attacked, was evident. This was especially shown by the results attained by vigorous local treatment in connection with the segregation of patients and general measures of disinfection. When by the thorough use of the actual cautery, or of fuming nitric acid, the entire wound was thoroughly and deeply cauterized, the infectious agent was destroyed, and the *vis medicatrix naturæ* proved sufficient to effect a speedy cicatrization of the deep and broad ulcers which resulted from the rapid sloughing and the heroic treatment required to arrest it. Facts of this kind, taken in connection with circumstances relating to the gradual development of malignancy in local epidemics of other infectious diseases, such as diphtheria and scarlet fever, and the evidence relating to attenuation of pathogenic power in known disease germs, cause me to give more weight to the supposition that this pathogenic power may in certain cases be an acquired physiological character, rather than an inherent and specific one, than is accorded to it by Koch and some other leading investigators in this field. I believe, however, that Koch admits the possibility that his cholera bacillus may be a pathogenic variety of a harmless organism. At least, he has submitted the question for discussion.

Klein, of London, also favors the idea that pathogenic power is a specific and constant character belonging to the micro-organisms which exhibit it. We must admit that this is true in the case of such diseases as small-pox and measles, if they are in truth germ diseases, for we have no evidence that these diseases ever originate independently of preceding cases, or that the infectious principle is capable of multiplication external to the human body; but I am very much inclined to believe, for reasons already given, that it is not true as regards the various septic organisms which are known to us by laboratory experiments. I am convinced, however, that there are among these lowly plants a large number of distinct species, each having its own independent life history, and each subject to modifications of function, and possibly of form, as a result of gradual changes in its environment.

Bilroth and some of the earlier observers maintained that the various forms of bacteria which are found in organic infusions belong to a single species of plants—the *coccobacteria septica* of the author named. But this view is no longer tenable; nor can I agree with Nägeli, that there exist but a small number of species, each of which may assume a variety of forms. This author has said, "Each of the veritable species of schizomycetes is not limited to presenting itself under the different forms of *micrococcus*, *bacterium*, *vibrio*, and *spirillum*, but can also show itself as the agent of the acidification of milk, of putrefaction, and as the agent producing several maladies." My own observations have convinced me that there are, for example, numerous species of micrococci, and that micrococci never, under any circumstances, develop into elongated or spiral bacteria, and do not form endogenous spores, their life history consisting in multiplication by binary division. I have had in cultivation at different times several different species of these minute plants, and have found that by proper precautions pure cultures may be maintained through successive generations—in other words, that the several species "breed true." Thus, the yellow micrococcus—*M. luteus*—produces successive generations of yellow micrococci; and although the individual cocci cannot be distinguished by their form alone from other micrococci having a different color, yet this character being constant is a sufficient specific distinction. The known species of bacilli which may be distinguished from each other by form, dimensions, or physiological reactions, are already sufficiently numerous, and I cannot doubt that the number of unknown species is far greater. Our knowledge of this extensive microscopic flora is still very incomplete, and is obscured by erroneous observations, and the confusion which has arisen from the minute size of these microscopic plants and the intermingling of numerous species in the same organic infusions. Methods of isolating and maintaining pure cultures of the several species which have been devised, and especially Koch's method of surface cultivation, together with improvements in technique and in optical appliances which have been made within the past few years, have, however, opened the way for rapid progress in the future; and we may hope that before many years we will know much more about disease germs than we know to-day, and that the important questions to which I have briefly referred, relating to their origin, relationships, and *modus operandi*, will finally be settled by the experimental method.

Unless, however, the few individuals in this country who have endeavored to take part in these researches receive more encouragement and substantial assistance from some source in the future than they have received in the past, we shall have the humiliation of still receiving our knowledge of disease germs at second hand, and of knowing that this great nation, which has taken the lead in so many branches of scientific research, has contributed little or nothing to this important subject.

I shall now endeavor to make you familiar with the morphology of a few disease germs, and with that of some harmless organisms of the same class, by projecting upon the screen some of my photographs from

nature—photo-micrographs. Should any gentlemen of the press be present, I beg that they will not refer to the objects which they are about to see upon the screen as "bugs," as did an intelligent reporter in New Orleans, in giving an account of a lecture illustrated in the same way, which I delivered in that city some years since. By the way, the popular idea of a disease germ, in the city referred to, at the time mentioned, seems to have been that it is a bug of some kind, for in the Mardi Gras procession of the same year, an honored member and vice-president of this association, whose death we were soon after called upon to mourn, made his appearance in *papier-maché* upon one of the flats, as engaged in fishing for germs. In his hands was a slender fishing-rod furnished with a hook and line, and from the hook dangled a nondescript creature which represented a recently captured germ, and which resembled a Louisiana mosquito more than anything else. Perhaps this was the most pestiferous creature with which the inventor of this tableau was acquainted. At that time a "germ-hunter" was thought, by many good citizens, and by not a few of our own profession, to be a crank who deserved no encouragement, and was a fair subject for the shafts of ridicule and scorn. But the world moves, and many of these honest citizens, including some of the then scornful members of our own profession, are now prepared to swallow germs served up in any style, so long as they are imported. And, indeed, they may, in my opinion, swallow with impunity some of these imported germs, as, for example, the *bacillus malariæ* of Klebs and Tomassi-Crudeli, or the yellow fever germ of Domingos Freiré, of Brazil.

Although I object to my disease germs being called bugs, I cannot find fault with another gentleman of the press, who, on a different occasion, gave his impressions of the morphology of the objects which he had seen upon the screen, by telling the readers of the journal which he represented that some of these objects looked like Bologna sausages, and some like oysters on the half-shell. You will at once recognize the Bologna sausages, when the photo-micrograph of a chain consisting of four bacilli is projected upon the screen; but I am still in doubt which of my photographs from nature suggested oysters on the half-shell.

XI.

ON THE PRESENT AND FUTURE OF SANITARY WATER ANALYSIS.

By MAJOR CHARLES SMART, M.D., U.S.A.,
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The investigation by Professor Mallet, for the National Board of Health, marks an important period in the history of water analysis. This work was carried out in 1881; but the full report has only recently been published, and its appearance, showing definitely what value attaches to present methods, suggests an inquiry as to the future.

But to appreciate the present and forecast the future, a brief notice of the past is needful. Usually in historical inquiries into questions akin to medicine, we drop back to Hippocrates; but in this instance the dark ages lasted until most of the members of this association had seen the light. Water, it is true, was analyzed before this recent time, but the analysis dealt and continued to deal with the saline matters, until sanitary inquirers discovered that injurious effects are seldom due to these when existing in the quantities usually present in ordinary potable water. They came, therefore, to look upon the formal inorganic analysis of the chemist, tabulated in grains per gallon, as a parade of accurate chemical work which had little bearing on the practical question of wholesomeness. They concluded that the knowledge they desired lay hidden in the intangible organic matter dissolved in the water, and they instituted experiments on it. Their methods were crude, and their results lacked precision, as this obscure organic matter refused to be precipitated and brought to the balance for a rule-of-three calculation to determine its quantity. What the sanitarians wanted was what many people want at the present time,—a something which, when dropped into a specimen of the water, would give information as to unwholesomeness by some striking reaction, such as a change of color, or the formation of a characteristic precipitate. But the scientific chemist knew, from the constitution of the organic matter, that the realization of this desire was as impossible as the discovery of the philosopher's stone or of the elixir of life, the pursuit of which absorbed so much of the energies of the alchemists, and discovered so much that is valuable to the human race.

The sanitary analysis of water may be said to date from the time when Forchammer, of Copenhagen, proposed the decolorization of permanganate of potash solution as a test for its organic matter. For a long time the status of this reaction was that of a curious laboratory experiment, as

the action of permanganate on organic matter, when present in the minute quantities usually found in water supplies, was too slow and ill-defined to admit of any practical advantage from its employment.

In the meantime, the recognition of the importance of the organic matter led, in the absence of a generic quantitative test, to a chemical attack upon it by the method of ultimate or elementary analysis. As organic matter consists mainly of carbon, nitrogen, hydrogen, and oxygen, it was believed that if an accurate determination of the carbon and nitrogen could be effected, an expression might be given to the relative amounts of organic matter in different water supplies, although the absolute weight of the organic substance would remain unknown. From this was finally developed the combustion process of Frankland and Armstrong, in which the residue of the water procured by a carefully conducted evaporation is burned *in vacuo* with copper oxide, and from the volume of the evolved gases the quantities of carbon and nitrogen in the organic matter are calculated. If the organic matter of water did not vary in its constitution, and were its unwholesomeness proportioned to its quantity, this would have been an excellent method of sanitary analysis. But it was readily appreciated that the organic matter collected by water is a mixture of many substances, some of which may have much carbon and little nitrogen, and others less carbon and relatively more of the nitrogen; and that while some of these substances are harmless, others may be deleterious. Animal matters, for instance, were credited with being more harmful, weight for weight, than matters of vegetable origin. But as the ratio of carbon to nitrogen is greater in the latter than in the former, the process of Frankland and Armstrong was found to be capable of indicating, in some instances, from which of the kingdoms of nature the organic matter was derived, and in so far of suggesting the possibility of harmful qualities.

But, in view of the preponderance of nitrogen in the more deleterious animal matters, and of its presence in all tissues that are vitalized (as contradistinguished from certain organic matters which, like starch and sugar, are simply the products of vital action), other experimenters regarded it alone, when accurately determined, as giving expression to the relative quantities of probably dangerous organic matter to be found in waters. The nitrogen in these organic substances was ascertained to be susceptible, in part at least, of ready transformation into ammonia, which could be estimated with great accuracy. And as the process of Wanklyn and Chapman, which is based on this transformation, required less time, special training, and manipulative tact than Frankland's method, it became extensively used and carefully studied by the sanitary analysts. This process also is capable of itself, and especially in connection with another process to be mentioned directly, of affording as definite evidence concerning the derivation of the substance which furnished the nitrogen as may be obtained by the more scientifically accurate method of combustion. But although, as has been shown by the writer, it is capable of detecting and estimating the urea of undecomposed sewage, it fails, as

does the combustion process, in the majority of instances to afford any direct testimony as to the character of the organic matter, and hence as to its wholesomeness or unwholesomeness.

Meanwhile, also, the capabilities of the Forchammer test by permanganate were assiduously studied, and methods were found not only of hastening the oxidation of the organic matter accomplished by its means, but of indicating with precision the quantity of permanganate required to effect this oxidation. It was found, however, that while the quantity of oxygen used is susceptible of accurate measurement, the whole of the elements of an organic matter known to be present is not in every case oxidized. Urea, for example, is not even effected by these permanganate processes. Other matters are susceptible of more or less oxidation; so that similar results are not obtained from equal weights of carbon and nitrogen in two or more water samples, unless the organic matters containing these weights are identical in chemical constitution. Waters containing the same kinds of organic matter may be graded in quality by these tests, but not those containing different kinds of organic matter. Nevertheless, in general terms, a water which contains a large quantity of organic matter will destroy a larger amount of permanganate than one which contains a small quantity; and hence the processes have a certain value. Dr. Tidy, whose name has been applied to one of the methods of using the permanganate, claims that animal matter is more rapidly oxidized than vegetable matter; but the experiments performed under Prof. Mallet's direction, to test this point, demonstrated that the animal or vegetable nature of the matter has but little influence on the rapidity of the action. If, however, these oxidations are viewed in connection with the nitrogen results yielded by Wanklyn's process, an opinion may in some instances be formed as to the origin of the matter. Thus, if a large amount of permanganate is destroyed, and a small quantity of nitrogen eliminated as albuminoid ammonia, the organic matter may be considered of vegetable origin with as much certainty as if a large amount of carbon and a small amount of nitrogen had been found by the combustion process, while converse results would indicate, with as much probability, an animal derivation.

It is readily seen that none of the processes mentioned convey more than that the water contains more or less of the elements of organic matter. But their authors have claimed for them the capability of deciding on the quality of the water by establishing limits on the scale of relative impurity within which a water is to be accounted wholesome, and beyond which it is to be considered suspicious or dangerous. In England these limits are accepted as the dicta of the authorities; and they are entitled to consideration as embodying the opinions of men who have had a large experience, biased perhaps by a partiality for or advocacy of a given process. But it is doubtful if any of the analysts of this country, in making use of the processes, have accepted without question the rules laid down for formulating the results into an opinion on the quality of a water. In fact, this doubt as to the value of the opinion based on the analytical

results, developed the investigation so thoroughly carried out by Professor Mallet for the National Board of Health. Proof was required that waters which fell within the limits were wholesome, and that those which exceeded them were more or less harmful. To elicit this, a number of water samples were procured, and submitted to the three methods of analysis by chemists who were in ignorance of the history of the waters on which they operated. Some of these waters were known by long experience to be productive of no harmful effects; others were regarded, on more or less sufficient evidence, as of doubtful or dangerous quality; while others, again, were specially contaminated with various organic substances which are likely to find their way into water-supplies. Of nineteen natural waters which were regarded as wholesome, only five were pronounced good by all the processes, although eight others were returned as good by some, and as fair, medium, or allowable by the others; three were accounted bad by one of the processes, one by two of the processes, and two by all the processes. Of twenty natural waters of doubtful but more or less suspected character, nine were reported good or allowable by all the methods, five bad by one method, three by two methods, and three by all the methods. Of twenty natural waters which there seemed fair ground for believing had actually caused disease on the part of those drinking them, ten were accounted good or allowable by all the processes, six bad by one of the processes, one by two of the processes, and three by all the processes.

In view of this record, Professor Mallet appears fully warranted in concluding that "It is not possible to decide absolutely upon the wholesomeness or unwholesomeness of a drinking-water by the mere use of any of the processes examined for the estimation of organic matter, or its constituents."

These results placed on a basis of experimental proof the opinion held by the analysts of this country, that the processes were valuable only as estimating with more or less accuracy the quantity of the organic elements present in water; but that the wholesomeness of the water, depending on the quality of the matter and not on its quantity, could not be determined by the analytical results. The words *good*, *fair*, *usable*, *allowable*, *doubtful*, *bad*, *foul*, &c., had at first been used by them not so much with the intention of expressing a positive opinion, as of conveying an appreciation of the results of the analysis to those who were not acquainted with its technicalities. That the sum of the organic elements, the free and albuminoid ammonia, or the oxygen required for the oxidation of organic matter, amounted to so many parts per 100,000 of the water, conveyed no meaning to the uninitiated, and required translation into an expression that could be understood. *Good*, *usable*, *foul*, &c., meant, therefore, merely that the results were similar to those which the analyst had obtained from waters known, on more or less satisfactory grounds, to be wholesome or otherwise. There was thus an apparent acquiescence in the principle of the British limit of wholesomeness, although not an acceptance of the specified limit. But afterwards these

adjectives became in many instances the expression of an actual opinion, though not based entirely upon the analytical results. The quantity of the organic matter, as determined by the chemist, led to inquiries into its derivation, with a view of throwing light on its quality. Many of these inquiries were conducted in the laboratory as a part of the systematic analysis. The quantity and character of the dissolved solids, the chlorides, nitrites, and nitrates, when considered in connection with the various points developed by the albuminoid and permanganate processes, often discovered much of value concerning the probable quality of the organic matter. The tables in Mallet's report, giving the analytical results of the series of one hundred and forty waters examined, contain also the remarks of the analysts on the probable history and character of each water. These are interesting as showing how closely, in most instances, they approached the truth, and as suggesting that, since the analysts had discovered so much concerning the organic matter, an inspection of the source and surroundings of the water-supply would enable them to point out the origin of the contamination. A knowledge of the history of the water sample, taken in connection with the results of the analysis, and with a knowledge of the normal characteristics of waters of similar history, will in all likelihood permit an opinion to be formed concerning the probable derivation and quality of the organic matter. This opinion necessarily modifies that which is based solely on the analytical results; for a water need not be reported as bad if its organic matter, although large in quantity, is manifestly harmless; and, on the other hand, a caution may be necessary concerning the use of a supply, if its organic matter, although trifling in quantity, is of manifestly dangerous origin.

The two natural waters, which were believed from actual use to be of good and wholesome character, yet were condemned as bad by all the analytical methods in Mallet's investigation, were the Cochituate water of Boston and the Mississippi river water of New Orleans. The quantity of organic matter in both exceeded the limits of wholesomeness assigned by the English authorities. But in these cases it would seem that the testimony as to their good and wholesome character may be questioned with as much propriety as the opinion based solely on the analytical results. Sewage in water may or may not be harmless: neither position has been proved. But it has been proved that after sewage has been in the water for some time it ceases to be sewage. Its organic matter becomes transformed into inorganic substances, and the water not only gives satisfactory results on analysis, but is probably wholesome. The organic matter of sewage containing the typhoid poison likewise becomes transformed, but the water, although giving satisfactory results on analysis, may be far from wholesome; for the transformation into ammonia and nitric acid, which takes place in ordinary sewage matters, does not affect the germ of that disease. Well waters, which on more or less satisfactory evidence have been associated with the spread of typhoid fever, have been found free from organic matter on analysis, though showing by the nitrates and nitrites present that they had not always been free from it. The typhoid

germ is therefore believed to be capable of resisting the destroying influences by which ordinary dead organic matter is reduced. River or lake waters which are exposed to sewage contamination must also be considered of doubtful quality, irrespective of the analytical results, until the cases of typhoid fever that occur in the cities supplied by them are traced to other sources than the water-supply. The recent researches of Koch indicate that cholera may be propagated by the diffusion of its microbe in water; and the theory that malarial fevers are due to a micro-organism which may enter the system with the drinking-water, is not without support.

In fact, it is not the dead organic matter in a water which renders it dangerous, but the minute and unknown organisms which are living, and perhaps growing and multiplying in it. There is ample proof that to cause intestinal troubles, the dead or putrescent organic matter, whether vegetable or animal, must be present in quantity easily recognized by the senses. At the same time the evidence is convincing that the organic matter, which should be the special object of sanitary analysis, is not to be detected by any purely chemical process.

It does not follow, however, that the work of the sanitary analyst is without value. So far as our knowledge extends, these micro-organisms are on the one hand connected with vegetable decomposition, and on the other with sewage. The detection of either of these points to a possible danger which in every instance should be avoided. Sanitary inspection is frequently able to indicate this danger; but where it fails to do so, chemical analysis will usually succeed. When an excess of organic matter is detected, and especially when its character is appreciated, a close investigation into the surroundings of the water gives full promise of discovering the source of the pollution. As a case in point: The cistern water at a gentleman's summer residence was suspected of having caused typhoid fever. The cistern was cleaned out and put in what seemed to be perfect condition, but the water, on analysis, was found to contain, with other organic matter, a certain quantity of undecomposed urea. The owner declared this to be simply impossible; but when the cistern was again emptied and subjected to examination, it was found to present three apertures of inflow, while only two conductors connected it with the roof. This discovery led to the remembrance that some years before certain alterations had been made in the building; and the third aperture was supposed to be the mouth of a disused conductor. This was found to be the case: the other end of the pipe was unearthed just below the surface near the porch, where grew some vines that were occasionally nourished with chamber slops.

Chemical methods are therefore of value, though they do not indicate the presence of the particular virulent matters which render drinking-water dangerous. It is impossible for them, in view of the principles on which they are based, to pronounce on the actual presence or absence of danger, but they afford the surest means of determining the possibility of danger. The true position of these chemical methods should be appre-

ciated by sanitary workers, that some of the energies spent upon them may be diverted into channels which promise more definite results. The living organisms should become the subject of persevering study. More than a dozen years ago Burdon Sanderson called attention to the bacterial fecundity of water. He added a few drops of the water under examination to a sterilized and protected nutritive liquid, and suggested that the quality of the water in some respects might be ascertained from the density of the resulting bacterial turbidity, and the rapidity of its development. But although the culture method as applied to water was thus long ago suggested, the idea has not been followed up except in a few of the European laboratories. Under Koch's direction, for instance, tests of the bacterial fecundity of the Berlin water supply are made daily by the culture method. The pursuit of the elements of organic matter has carried the analysts past the real object in view; but it is time that their retorts and combustion tubes should give place, in part at least, to the microscope and culture experiments. These offer the best prospects of a solution of that difficult sanitary problem,—the quality of our water supplies. Ultimately they will probably render the chemical methods unnecessary. By working in this direction the analysts will prepare themselves for the change of methods, while their labors will undoubtedly hasten the arrival of the time when they will be able to give an opinion embodying certainties instead of probabilities—when they will be able to say with truth, that a given sample of water is wholesome or unwholesome, as the case may be.

XII.

POLLUTION OF THE UPPER OHIO, AND THE WATER-SUPPLY OF THE CITIES AND CHIEF TOWNS WITHIN THE FIRST HUNDRED MILES OF ITS COURSE.

By JAMES E. REEVES, M. D.,

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The condition of health and probable duration of life of a people may be correctly measured by the quality and quantity of their water-supply. Indeed, good health can as little be supported without pure water as without pure air; therefore, of all the diversified and complex relations which man bears to surrounding influences, none are more important than that which relates to the water-supply of the locality in which fortune has placed him.

Considered either in his physical, social, moral, industrial, or political relation, the subject is of transcendent importance, for it involves the main questions of success in life. If he take up his abode in the midst of unsanitary surroundings, the inevitable sequence will be a correspondingly unfavorable influence upon his destiny, a check upon his prosperity, and a blight, more or less serious, upon all those attributes which are usually considered essential to his well-being and happiness.

As a natural corollary, the community which is ignorant or regardless of its sanitary surroundings and vital history is but feebly defended against "the pestilence that walketh in darkness, and the destruction that wasteth at noonday," for the wholesome lessons of domestic and civic hygiene afford to such a people no rules and defences for the person, the domicile, the municipality, and the state, nor encouragement to the general prosperity in stimulating the practical applications of science and art, commercial enterprise, manufactures, and popular intelligence. All these are at a low standard, while frequently recurring endemic and epidemic diseases, and a high death-rate, constitute the most prominent features of their culpable history.

River pollution from sewage, and other supplies of refuse and corruption in towns and cities, has assumed such fearful proportions that the question presses itself upon wise men and sanitarians,—Is industry free to tumble out whatever horror or refuse it may have accumulated into the nearest crystal brook, regardless of gods and men and little fishes?—is free industry free to convert all our creeks and rivers into sewers? "It is ours," says Dr. Gairdner, "to use air and water, and then pass them on; but woe to the man or the community that detains or imprisons these his servants of the hour in their further execution of God's endless work!"

With these introductory reflections I now submit the following briet statement of facts relating to the water-supply of the cities and chief towns situated on the banks of the Ohio, within the first hundred miles of its course.

Commencing at the head of the Ohio, there are two cities, Allegheny and Pittsburgh, whose aggregate population is not less than 240,000. Next, Rochester, Pa., a town of 3,500 population; next, East Liverpool, O., with a population of 6,000; next, Wellsville, O., with a population of 4,500; next, Steubenville, O., with a population of 14,000; next, Martin's Ferry, O., opposite Wheeling, with a population of 4,000. On the West Virginia shore, between Wheeling and Pittsburgh, the principal towns are New Cumberland, with a population of 1,500, and Wellsburgh, sixteen miles distant from Wheeling, with a population of 2,000; next, Wheeling, with a population of 31,500; next, Bellaire, O., with a population of 10,000.

And thus, not including Bridgeport, O., immediately opposite Wheeling, and many smaller towns and thriving villages which mark every few miles of the Pennsylvania and Ohio shore, and whose varied industries in manufactures give employment to thousands of laborers, there are above Wheeling four cities and five towns whose aggregate population amounts to 275,000.

Besides refuse representing accumulations of filth of every conceivable character from family domiciles, manufacturing establishments, stables and barn-yards, privy vaults and other cesspools, and sewage outlets, the Ohio river is made the convenient receptacle for the disposal of diseased or worthless carcasses; and thus thousands of tons of corrupting matter are daily thrown into the stream which supplies the water we drink. No wonder then that diarrhœas and typhoid fever are so common, and the death-rate from these diseases is so high.

But let me be more specific in my statements. Passing Rochester, at the mouth of Beaver river, twenty-six miles below Allegheny and Pittsburgh, without further record than that its water supply is from wells contaminated with surface putrilage, and in many instances, no doubt, by leaks from privy vaults and drains from kitchen sinks, and that typhoid fever is a frequent disease in that community, we come to East Liverpool, nineteen miles further down the stream. Here the population is supplied with water pumped from the Ohio, and distributed from a reservoir. The supply pipes to the pumps are located about two hundred yards above the city, and extend into the river far enough to take the water from the current, below low-water mark.

There are but few wells in use, and fewer cases of typhoid fever have occurred since the erection of water-works than before, or when the water-supply was wholly drawn from wells. During those years house and street epidemics of typhoid fever were not infrequent.

At Wellsville, four miles below East Liverpool, a well, or crib, as it is called, was made near the river's edge a year or two ago, for the purpose of securing for the town a sufficient supply of clear water, the authorities

believing *clear* water and *pure* water to be convertible terms. This crib, 10 by 16 feet in the square, and 12 feet deep, was encased with timbers, and tightly covered with the same material. From such "a hole in the ground" the water-supply was pumped into a larger basin on the hill. It was confidently expected in that way to procure "pure filtered water from below the bed of the river;" but the supply was found to be so foul and unwholesome that it was not fit for use, and the crib had to be abandoned. Since then the supply has been pumped directly from the river, above the inflow of the town's refuse, and distributed from a reservoir three hundred feet above the river level. But this better water-supply has not secured the citizens of Wellsville against typhoid fever cases, which appear at all seasons of the year.

For the foregoing history of the sanitary situation in East Liverpool and Wellsville I am indebted to R. H. Hill, Esq., of East Liverpool, and to Dr. J. W. Hammond and S. Stevenson, Esq., of Wellsville.

From Steubenville, twenty miles below Wellsville, Dr. Gustav Shane, of that city, has kindly sent me the following description. He says,—"This city is supplied with water pumped from the Ohio river into a large reservoir on a neighboring hill, and from thence direct to the consumer by mains and cross-mains. The basin or reservoir is made of brick laid in and covered with cement, and of sufficient capacity to supply the ordinary wants of the population—fourteen thousand—for about three days. The supply is taken at a point *below* both the geographic and population centre of the city, but the receiving pipes are laid to and beyond the channel, so as to avoid contamination from surface drainage and sewage.

"The quality of the water drawn from the mains is apparently good, clear, free from odor, and not unpleasant to the taste except when the river is turbid. But few wells are in use in the main portion of the city, but a part of one ward, on the first river bench, is partially supplied with well-water.

"The city is not sewered, and the privy system is the time-honored one of deep vaults, which, when full and abandoned, are covered with earth, and in that way the surface is completely honeycombed.

"There are, at all seasons of the year, cases of typhoid fever occurring sporadically; but the disease has not prevailed as an epidemic for many years. The part of the city in which well water is used appears to have the largest percentage of febrile cases, and, I believe, a preponderance of the typhoid type. Dr. Stanton, the oldest practitioner in the city, whose experience antedates the river water-supply, informs me that typhoid fever was much more common under the well-system of water-supply than since the establishment of the water-works. Thirty-five or forty years ago, or before the adoption of the river supply, house and neighborhood epidemics of typhoid fever were quite frequent; whereas, at present, such outbreaks are almost entirely unknown.

"Isolated cases of diphtheria are also constantly occurring at irregular intervals in Steubenville, but there has been no general visitation of this

disease within the last fifteen years. During the winter of 1878 and 1879, a fatal neighborhood epidemic of diphtheria occurred, limited by street lines, and embracing about one fourth of the population of the city. Scarlet fever prevailed at the same time in severe form, and in many instances the two diseases, scarlet fever and diphtheria, were associated in the same patient. There seemed to be no cause for this visitation other than contagion."

The next place on the line of this inquiry is Martin's Ferry, twenty miles below Steubenville, and nearly opposite Wheeling. Here the water-supply is from wells varying in depth from fifteen to fifty feet, dug through a rich loam, yellow and blue clay, sand and gravel. The town is not sewered, and in some instances the well and the privy vault are in dangerous proximity. On account of the general topography of the town, and the superficial clay substratum, all refuse and surface matter which does not find immediate entrance into the well-water supply is quickly drained into the Ohio river. The result of the unsanitary condition is the constant prevalence of typhoid fever of a grave and fatal type in Martin's Ferry.

And now, having reached Wheeling, the chief city in West Virginia, the situation is even more uninviting than the unsanitary pictures we have been inspecting; for it is within the truth to tell, that, including the population of Martin's Ferry, the refuse from the homes of ten thousand people finds entrance into the Ohio river immediately *above* the point of supply to the water-works' pumps. And if filth from hundreds of households, manufacturing establishments, privy vaults, and other cesspools, horse and cow stables, and the stinking bodies of dead animals, were all of the sources of pollution of the water-supply of Wheeling, its citizens might congratulate themselves that, at least, they are not worse off than some of the neighboring cities; but in addition to the sources of pollution just mentioned, an old and dilapidated cemetery, Mt. Wood, occupying the hill at the northern part of the city, and within a half mile above the water-works, is a highly probable factor of contamination.

The greater part of the coal measure underlying this cemetery has been removed, and the cap-rocks have broken and sunken, causing large seams or cracks through the hill; and the inclination of drainage, both surface and subterranean, being toward and into Jonathan's ravine, which empties its current into the Ohio river within the city limits, it is therefore highly probable that the water-supply in the basin is polluted by the corruption escaping from the graves and vaults in Mt. Wood.

The water-works, though greatly improved by new machinery within the past year, occupy the same site upon which they were originally erected more than forty years ago, when Wheeling had not one fifth of its present population (31,500).

The basin or reservoir is located on Wheeling hill, 275 feet above the bed of the river, and has a capacity of 800,000 gallons. Its small size necessitates constant use of the pumps, both day and night, to keep the mains full; therefore at all times the quality of the water in the basin is

the same as that in the current of the river. In other words, if the water in the Ohio is muddy, the supply in the basin is likewise turbid and disagreeable to drink.

In hope of securing a clear and wholesome water, but unmindful that clear water is not always pure water, the board of water commissioners last year concluded to repeat, with some improvements, the experiment made at Wellsville, of a crib or well below the bed of the river; and accordingly a hole 15 feet deep and 20 feet in diameter was dug through the sand-bar in the bed of the river near the island shore, and about two hundred yards above the present point of supply to the basin. This well or crib was substantially walled with brick laid in cement, and tightly covered with heavy timbers bolted to the wall to prevent all leakage from the current. The water that soon filled this well or crib, by percolation, was so clear and beautiful in appearance, that the board contemplated the immediate establishment of three additional cribs side by side with the one just described. Fortunately, however, before making such outlay of the public money, and connecting such cribs or wells with the water-works and the basin, the board wisely determined to have the waters in the crib and in the basin analyzed, and specimens were forwarded to Dr. Charles Smart, of the United States army, for that purpose. The following is Dr. Smart's report of the analysis:

SURGEON-GENERAL'S OFFICE,
WASHINGTON, D. C., September 26, 1884.

DR. JAMES E. REEVES, *Secretary State Board of Health, Wheeling, W. Va.:*—

DEAR SIR: I have received yours of the 18th inst., invoicing two half-gallon specimens of the water-supply of the city of Wheeling, W. Va., and requesting me to make an analysis of the water, and to report in such terms as may be authorized by the results of the analysis. The specimens were received in good condition, in green glass bottles, securely corked. One was marked "No. 1, Island Crib;" the other, "No. 2, City Reservoir."

No. 1. This water was clear, transparent, and free from color and odor. A slight sediment of a dark color, pulverulent and somewhat granular, had collected in the bottom of the bottle. This sediment consisted of organic matter so disintegrated that its origin could not be discovered; several of the larger granules were composed of the disintegrated matter aggregated on small fragments of cotton fibre. It swarmed with bacteria and bacilli, and showed many minute protoplasmic masses, and some larger masses presenting amœboid movements, but contained none of the algæ and infusoria which are so common in waters that are in general use as potable waters. Generally speaking, waters that are free from the actively-moving ciliated infusoria, and that present a comparatively dead microscopic field, are waters that have percolated through a very pure or a very impure soil. In other words, they are very pure spring or very foul well waters. In the one case, the field presents silicious particles, diatoms, and the filaments of the confervoid genera; in the other, the microscopic appearances are those mentioned as observed in the sediment of the specimen under discussion.

Under laboratory treatment the water was found to give a residue constituting 49 parts in the 100,000. Twenty of these parts were dissipated by heat, and consisted principally of the nitric acid of nitrates. There was but little recent organic matter in the residue, scarcely enough when ignited to darken the inorganic film with a fleeting coloration. In this respect, the water residue was similar to that of a pure spring water; but it differed from the latter in the strong nitrous fumes which were evolved during the application of the heat. The presence of the nitric acid was also developed by Sprengel's solution, but

it was not considered needful to determine its amount directly, as the operations on the residue indicated that two thirds of the 49 parts in every 100,000 of the water consisted of nitrates, and the remainder of chlorides, carbonates, and sulphates.

The chlorine present amounted to 1.9 part in 100,000 of the water, which is equivalent to 3.1 parts of chloride of sodium. This is not a large chlorine figure, considered in connection with the nitrates present, and indicates that the organic matter whence the latter are derived is not wholly, or, indeed, chiefly, a sewage material, although sewage may be present in it.

The free ammonia in the water measured .014 part per 100,000. This is a larger quantity than is usual in percolated waters known to be of good quality, and indicates, with the strong trace of nitrous acid which was found by Griess's delicate test, that the organic matter from which the nitrates are formed is not distant from the reservoir in which the water is collected, or that the filtering material or soil through which percolation is effected is itself of such an impure character as to be incapable of effectually purifying the water in its transit.

A similarly small amount of recent organic matter is indicated by the quantity of oxygen required to oxidize it, to wit, .110 part per 100,000 of the water.

From the rapid manner in which the albuminoid ammonia was eliminated in the laboratory experiment, from the relatively small proportion of carbon present as indicated by the small quantity of oxygen required, and from the large amount of nitrates and small amount of carbonates in the residue, it is inferred that the small quantity of organic matter present in the water, and the very large quantity which has recently been reduced to the inorganic form of a nitric acid salt, are of animal derivation. No undecomposed sewage is present in the water, but the quantity of chlorine renders it probable that decomposed sewage is not absent.

In the absence of all knowledge of the surroundings or natural history of this water, the analyst cannot speak with decision on its probable unwholesomeness. The microscopic appearances of its sediment are against it, as well as the greater part of the analytical results. It is true that there is in the water only a small quantity of unreduced organic matter, but there was a much larger quantity present in it a short time before it reached the reservoir whence it was drawn. This water, indeed, appears to be an example of the class which led the writer to generalize as follows in his report on the waters of Memphis and other Southern municipalities ("Annual Report National Board of Health, 1880," page 485): "On the other hand, when a well which is liable to an impure inflow, as evidenced by the coexistence of nitrates and nitrites, furnishes a sample which is free from albuminoids and from oxidizable organic matter, the microscopic characters may give direct assurance that the water has not always been as pure as the sample submitted for analysis."

Although there is not much organic matter in the water submitted, the surroundings of the reservoir from which the water was collected are evidently such that at any time an increased inflow might carry undecomposed organic matter into it. As it is, the last traces of the organic matter are in progress of change. The nitrogen of the nitrates in a water may be as much dissociated from the organic matter, which it at one time constituted, as the chlorine of the chlorides in the water of the ocean; but in this instance the nitrates are undoubtedly a recent formation, for the process of reduction is in progress in the water submitted for examination. Nitrates alone are viewed by most sanitary authorities as indicating dangerous probabilities in a water. Frankland says that large quantities of nitrates convict water of previous pollution by organic matters of animal origin, and calls them an indication of the "previous sewage contamination" of the water. Some, as Ekin, of London, condemn as dangerously polluted waters which contain so small a quantity of nitrates as .5 or .6 part per 100,000; and Reuben Haines has met with cases which sustain Dr. Ekin's position. Without subscribing to the dangerous qualities of waters which contain so small a proportion of nitrates, the experience of the writer leads him to believe that, excluding the presence of existing organic matter, a water is to be regarded with suspicion in proportion to the amount of the nitrates present, and that assuredly the water-supply of a city should not contain the very large quantity of nitrogen as nitrates which was found in the sample marked "No. 1, Island Crib," from Wheeling, W. Va.

More particularly dangerous are the waters which show a connecting link between the nitrates and their organic derivation in the form of traces of existing nitrites. In a recent investigation into the processes of water analysis, Professor Mallet, of the University of Virginia (now of Jefferson Medical College, Philadelphia), under whose direction the experiments were conducted, concluded that the danger was associated with the presence of nitrates and nitrites. In his report (page 203, "Annual Report National Board of Health, 1882"), he says,—"Looking at the results from the natural waters of class I and II, and bearing in mind the conclusions reached by Müller, Schlaesing and Muntz, Storer, Warrington, and others, as to the process of nitrification being due to the presence of an organized ferment or ferments of bacterial character, the idea suggests itself whether the noxious characters of waters containing largely nitrates and nitrites, themselves presumed to be harmless, and but very little organic matter, which ought to be present, of some sort, to support the previous contamination view, *may not be in reality due to the presence of a specially nitrifying ferment, itself to be classed among the lower organisms capable of propagating disease.*"

Nitrates and nitrites are harmless in themselves, so far as we know. So, also, are the ordinary organic matters, animal and vegetable, from which these salts are formed, at least when existing in quantities which do not render the water containing them repugnant to the senses. It is not the ordinary organic matters of the world,—decaying garbage, animal fragments, and even sewage, nor the nitrogen salts formed from them,—that are dangerous when taken into the system with the water-supply, but certain morbific micro-organisms which may accompany them. These micro-organisms, which are the probable cause of cholera, typhoid fever, and other specific diseases, are associated in particular with waters which contain nitrates and nitrites; and, indeed, it is not unlikely that the living ferment which effects the nitrification of organic matter may itself be morbific.

No. 2, City Reservoir. This water was clear, transparent, and free from color and odor. It contained a slight pulverulent sediment of an olive color, which consisted of disintegrated organic matter, and some mineral particles, swarming with infusorial life, but without any algoid forms and with few bacteria.

The water yielded a residue amounting to 14 parts in the 100,000; of these, 10 parts were mineral matter and 4 organic and volatile. The organic matter was not present in such quantity as to give a dark coloration on ignition of the residue, nor were any fumes or odors evolved during the process. Chlorine was present to the amount of 2.1 parts, equivalent to 3.5 parts of chloride of sodium in every 100,000 parts of the water. No nitrates were present other than the minute quantity, less than Dr. Ekin's limit, usually found in river waters. A trace of nitrous acid was present, indicating that the organic matter of the water was undergoing change to the inorganic condition. The free ammonia amounted to .013 part, and the albuminoid to .017 part per 100,000 of the water, while the oxygen required to oxidize this weighed .160 part.

River waters are very variable in their constitution. During the periods of spring snow meltings and autumnal rain-falls, when the stream is swollen and turbid, its waters usually attain their maximum of impurity. The organic matter on the surface of the area of drainage is washed into the bed of the stream, and the rapidity of flow prevents sedimentation, which is an important purifying agent. In seasons of drouth, on the other hand, when the water-level is low and the current fed less by surface-shed rain-showers than by tributary springs, the water is usually less impregnated with organic matter. From the transparency of the sample furnished, and its minute quantity of pulverulent sediment, the analyst infers a low water-level at the time the specimen was collected. The specimen, therefore, represents the river water in its best condition. The albuminoid ammonia distilled from the sample is not above the average of that obtainable from good river waters, but the free ammonia and chlorine are in excess, and suggest a sewage inflow into the stream. If sewage were suspected to enter in mass at one particular point, its influence on the quality of the water might be ascertained chemically by determining the free ammonia and chlorine in specimens collected above and below the point of supposed entry; but usually such determinations are unnecessary, as the point at issue may be better determined by a sanitary inspection of the area of drainage.

Sewage is decomposed by the influences acting in running water, and leaves only its

skeleton in the form of the inorganic chlorides. The presence of the evanescent ammonia indicates a more recent contamination and a less perfect decomposition. But whether decomposed or undecomposed, sewage contamination is dangerous, not in itself, for waters polluted with sewage have been used for ages with impunity, but in that it may be accompanied by and be the means of spreading the infection of typhoid fever and cholera. The former has long been known to be preventable by the use of water which is free from sewage contamination ; and the recent researches of Koch into the etiology of the latter indicate that a sewage-contaminated drinking-water supply is the most active agent in its propagation.

Respectfully submitted.

CHARLES SMART,
Surgeon U. S. Army.

The following supplemental report is not less interesting and instructive.

SURGEON-GENERAL'S OFFICE,
WASHINGTON, D. C., September 29, 1884.

DR. JAMES E. REEVES :—

DEAR SIR : Your letter of the 26th instant, informing me of the history and surroundings of the water sent to me for examination, and marked respectively "No. 1, Island Crib," and "No. 2, City Reservoir," has been received and carefully considered in connection with the analytical results obtained from the waters in question. In my report on "No. 2, City Reservoir," I stated the probability of sewage inflow, and suggested a sanitary inspection of the drainage area as a more trustworthy means of determining a contamination of this character than is the laboratory work of the sanitary chemist. If the sewage is present in large quantity, and is not decomposed by natural causes, the urea present may be detected and estimated by the chemist. But urea is speedily broken up, and leaves only the chlorides which accompanied it, without a trace of free ammonia to evidence its recent existence. The sanitary inspector is, therefore, better qualified in many instances than the sanitary chemist to detect the presence of sewage in a water. Especially is this the case in surface waters where the water-shed, and all its possible polluting influences, are more or less known.

The germ or poison of typhoid fever may or may not be present in sewage. If it be not present, the sewage is harmless, so far as concerns the propagation of that disease ; if it be present, the water will convey the infection of typhoid fever whether the sewage is decomposed or not. In fact, there is no evidence that the agencies which destroy ordinary organic or sewage matter in its course down stream have the slightest influence in destroying or removing the cause of this fever. On the contrary, all the evidence that has accumulated of late years shows the persistence of the germ or poison after the destruction of the sewage material which originally accompanied it. In the Lausen epidemic, for instance, there was not only a flow of several miles, but a filtration through the soil which sufficed to remove the minute cells of wheat starch ; yet the fever was undoubtedly disseminated by the infected water of the springs.

Instances of typhoid fever caused by well-water, from which all trace of the sewage has disappeared, are of common occurrence in the recent records of medical progress. Before a city which uses a sewage-polluted water-supply can claim that the use of such water is not injurious or unwholesome, its health reports should show that typhoid fever is a rare disease among its citizens, although existing in the cities which cast their sewage into its water-supply.

The detection by chemical means of sewage in a water is, therefore, a matter of no moment. The point of interest is the contamination of the water-supply. If this is proved, the water is dangerous, and is undoubtedly the cause of much preventable sickness, which is accepted by force of habit as a normal condition.

It is not always in the power of an individual to prevent the sewage-pollution of his water-supply by others who live above him on the water-shed, but it is always in his power to prevent his water-supply from being defiled by his own excreta. The sanitary laws which apply to individuals apply to their aggregation as communities. The city may not be able to prevent all defilement of the stream, but it is surely competent to preserve its

citizens from swallowing their own filth, diluted but not rendered innocuous thereby, in its organized system of water-supply.

The water marked "No. 1, Island Crib," which I reported to you as a surface water that received a large amount of nitrates and nitrites during its percolation through some filtering material, I now understand to be the river water which has percolated through a sand-bar into a well or other reservoir. When the river is flooded and turbid, the filtration, of course, will remove the turbidity and give a clear water. But clearness and purity are not synonymous terms when applied to water-supplies. A water which contains strychnia might be perfectly clear. The Lausen water, in Switzerland, above referred to as having caused a deadly epidemic, was perfectly clear. At the present time the river water is as clear as the filtered water. They are, however, by no means the same waters. The one contains only 14 parts of solid matter per 100,000, the other 49 parts. The increase is the result of the filtration. It consists of nitrates and nitrites recently formed from organic matter. The organic matter which yielded them did not exist in the river water. It was therefore derived from the filtering medium, and freedom from turbidity is purchased at the expense of a dangerous change in the character of the water. I need not repeat what I have already said in my report as to the quality of this water. It is wholly unsuitable for a potable water-supply, especially for a large community where the well-being of so many is at stake. Sincerely yours,

CHARLES SMART,
Surgeon U. S. Army.

It is thus seen how narrowly the people of Wheeling escaped a positively dangerous water-supply, and it is to be hoped other communities may profit by the example. When Dr. Smart's report is read by the light of the history I have given of the surroundings of the water-supply, especially by the light of that unerring indicator of the character of the water-supply—the frequency of typhoid fever—it leaves no doubt on the subject.

An interrogation of the death returns on file at the city health office shows that in the last ten years there have been 460 deaths from typhoid fever in Wheeling, and 225 deaths from diphtheria within the same period. Indeed, typhoid is present at all seasons, some years showing a much larger mortality than in others. For example: In the year 1879 there were 90 deaths in Wheeling from typhoid fever, while in 1880 there were but 52 deaths from the same cause. The same is true of the prevalence of diphtheria.

There is an easy remedy for the present impure water-supply in the city of Wheeling, namely, the extension of the receiving pipes three miles up the river, or to a point above the town of Martin's Ferry. When this improvement shall have been made, Wheeling may justly boast of having an abundant supply of the purest water the Ohio river can furnish, and fewer cases of typhoid fever.

The next and last city to be named in this record is Bellaire, O., the northern limit of which is but half a mile below the southern boundary of Wheeling. It has a population of ten thousand, and is supplied with water pumped from the Ohio at a point within half a mile below the place used by the city of Wheeling for dumping night-soil and other corrupting refuse. In other words, the citizens of Bellaire swallow with the water they drink all manner of abominable filth from the city of Wheeling, and they pay a fearful penalty for their utter disregard of sanitary laws. Typhoid fever and diphtheria prevail in malignant form at all

seasons, and the death-rate from these diseases exceeds that from all other causes combined.

Finally, it were well if the boasted civilization and refinements of the age in which we live could be presented in fitting contrast with the sanitary works of the ancient Greeks and Romans, who well understood the value of pure water. Vitruvius informs us that as an evidence of the practical wisdom of the ancient Romans, who were often regulated in their conduct and opinions, especially in military matters, by the augurs and soothsayers, they frequently consulted the appearances presented in the livers and spleens of animals with a view of ascertaining the state of the air and the waters of a country, the healthfulness of its food productions, its pasturage, etc., and to regulate their choice of sites for the building of cities. Even to this day, though so far fallen from her high estate, Rome is supplied with good water conveyed from a great distance by aqueducts which were built in the days of her splendor and renown.

XIII.

THE TRUE VALUE OF CHEMICAL ANALYSIS IN DETERMINING THE HYGIENIC PURITY OF POTABLE WATER.

By THAD. M. STEVENS, M. D.,
MEMBER INDIANA STATE SANITARY SOCIETY,
Indianapolis, Ind.

The chemical analysis of potable water is important, but in our opinion too much importance has been attached to it in the determination of the hygienic value of such water. Not only chemical analysis, but examination with the microscope, will often fail to reveal the detrimental nature of the water. How then, it may be asked, shall we determine its hygienic status? In discussing the subject of malaria, we are forced to admit that we cannot by any means detect the *materi morbi*, but there are two modes by which we are assisted in our endeavors to avoid it.

1. When it shows its presence by its effects, we fortify against it or avoid the locality.

2. Knowing from experience the conditions inseparable from its habitat, we seek to remove such conditions, taking them as the cause of malaria.

In like manner, where examination of water will not reveal any hurtful material contained, we have either to wait for some visible effect produced from its use, or view the surroundings of the water-supply, and in that way form our judgment as to its usable values.

Water is often brought to the chemist for his examination. He does not know its source, but is expected to not only give a faithful report of what he finds it contains, but also to hazard an opinion as to its hygienic purity. Such opinion can only be based upon his examination in the laboratory. If he finds nothing that is hurtful, then it is taken as proof positive that no harm can result from its use.

This is all wrong, for not only are the clear and sparkling waters often most deadly in their nature, but the most careful search by all known means often fails to detect the hurtful agent. For this reason the chemist tables should not be relied upon: the results of his examination must be held only as adjuncts. The source of supply must be critically inspected, and if that be open to suspicion the waters should be used with caution, and no surprise should be expressed at any harm resulting, notwithstanding the water be pronounced by the chemist as first class. Again, the determination as to the hygienic condition of water, judging from what may be found by the chemist, is often erroneous. For instance, the

chemical analysis may show a large amount of nitrates and nitrites: those are not of themselves hurtful; they only show that nitrogenous organic matter has at some time been contained in the water, but has suffered oxidation to the extent indicated by such chemical compounds. It may not show even that much, for the products of oxidation may appear while the actual undecomposed or decomposing material may never have entered the water from which the specimen was taken.

The oxidation may have taken place outside, and the products, as nitrates, nitrites, etc., may have entered the water supply by drainage. It is reasonable to suppose that water of the third stream, some ninety or one hundred feet below the surface, is not to any great degree affected by previous sewage contaminations, but the amount of nitrates and nitrites that are generally found in specimens of such water would indicate even a greater amount of this contamination than in the upper or surface stream, from whence water is obtained by means of common dug wells. Just where such chemical compounds come from, or how they gain access to the deep hidden body of water, that is without doubt the most wholesome we have, is difficult to find out.

We believe that in many cases such compounds, held by many as indicative of previous sewage contamination, are in fact the results of a combination of the elements from other sources, as, for instance, the inorganic nitrates and nitrites to be found in the soil and rocks. The indications attributed to the presence of ammonia, or albuminoid ammonia, are open in a less degree to the same objection and doubt.

In fact, we may safely assert that there is nothing that proves water unwholesome but the actual presence of organic nitrogenous matter, either intact or undergoing decomposition (leaving out of account inorganic impurities); and it is our opinion that even this is to be taken as suggestive only. If in such cases we find nitrates, nitrites, albuminoid ammonia, etc., we have indications that the material is undergoing changes; there appear but few other indications of value; the real source of trouble must be sought for elsewhere.

It is necessary to know that water is often unwholesome when there are no very plain indications of the fact offered by chemical analysis, and also that even when certain substances, generally held as indicating its dangerous character, are present, the water may be usable. We must acknowledge that certain modes of chemical manipulations are so intricate, and the examination is carried into minutia to such a degree, that confusion occurs, and instead of clearness of deduction we have ambiguity and non-reliable inferences.

The so-called "gas analysis" of Franklin, even if we were able to successfully conduct it in all its details, is so refined, and, so to speak, microscopic in its nature and results, that we are not certain the results are at all times reliable.

We should, in our opinion, when we seek for the hygienic status of a specimen of water, examine it in every way at our command,—its smell, taste, and general appearance, by the microscope and chemical analysis;

but when making such analysis it should be kept in mind that the point of greatest importance is the detection of organic materials, and that the compounds held as indicating previous sewage contamination are of secondary importance, and at the same time we should avoid the intricate chemical processes we have alluded to. We should know and study the surroundings of the water-supply, so that whatever is found by analysis shall be supplemented by the effects of such surroundings upon the supply;—in this way only can a proper judgment be formed. Often a water-supply may be condemned or approved in view of the surroundings alone, leaving the result of a chemical or other examination out of the question. Taking this proposition as a text, let us examine some of the most apparent conditions and surroundings that should cause us to condemn a water as unfit for potable use.

First, all streams that pass through a country containing an average population should be eliminated from the list of potable water-supply, and this average of density of population must be judged according to the rural population; for whenever the stream passes near or through a city or town, or when the population that studs its banks is dense, then without question no water should be taken from it for drinking purposes. We might make an exception in some few cases, if the trouble were taken to boil the water before using; but this will scarcely ever be done, nor will the best of care insure from harm.

This proposition will no doubt appear to many as ultra and impracticable; for, while it is admitted that water from streams befouled by the sewage of cities should not be furnished to consumers, it is next to impossible to obtain a sufficient supply from other sources, and the evil that all observe and deprecate is permitted, while often wild and inefficient methods are suggested of purifying such waters. That water taken out of a stream above the point of entrance of a city's sewage, while there is another city pouring its filth into the same stream fifty or sixty miles above, is not properly purified by oxidation, is an idea that is often considered too visionary for serious consideration; but that this is a fact we are satisfied.

There are several reasons why many use such water with complacency. The first is, that they have imbibed false ideas as to what will befoul the stream, or else think that such materials, having entered at a point a certain number of miles removed from the location supplying the drinking-water, have in some way been changed and rendered innoxious.

While we admit that much of vegetable, and indeed animal matter, in certain stages of decomposition, may often be taken into the system without perceptible harm, still we cannot deny that it is often unseemly and disgusting to imbibe water that is known to be befouled, although the risk of being poisoned is not great. But aside from all this, it is evident that germs of disease, or any poisons that may be associated with such matter, will act in minute quantities, and that some few will be affected according to the amount of such material cast into the streams.

We cannot then place much reliance upon the theory as to any changes

that may take place in disease germs, or poisons that induce disease, by reason of oxidation, while travelling a few miles of a flowing stream. Dilution has more to do with the seeming disappearance of such material than does oxidation, so that when there is found a less amount of unchanged organic material in a given amount of water from a stream, taken fifty miles below the point where a sewer enters, than there is found in the same amount of water taken at the sewer's mouth, it is by no means to be taken as a proof that oxidation has taken place to any great degree. The organic matter has been dispersed throughout a larger amount of water, but is still to be found unchanged. The surroundings, then, of a stream of water should be taken into account, and will often be sufficient to decide as to whether it is a proper source of supply for potable water, and this irrespective of what may be shown by chemical analysis or other means.

The same may be said with a greater degree of certainty of wells, springs, etc. A greater or less amount of unchanged organic matter found in the water of a well makes but little difference if the surroundings are such as should condemn it as a source of supply, for the disease-producing material may be present and no organic matter be detected.

As we have stated that the presence of nitrates and nitrites is not positive indication of the presence of organic material or the previous sewage contamination of such specimens of water, so the absence of what we term polluting material is not positive indication that such water is suitable for potable or household purposes.

Such propositions as these may, and if true, should, lessen our faith in the supreme importance that is often given to chemical and microscopical investigations as proof for or against the proper purity of water. We have known chemists, who know or care but little as to any other mode of forming a judgment relative to the hygienic purity of water than the elaborate analysis and searching microscopical examinations, write out a list of indications, give lengthy tables of compounds that were found, and talk glibly of all the hypothetical substances that may be found, and decide that the best potable water in the universe was of the worst character, or, again, upon failure to find a certain per cent. of one or more certain compounds, certify to the healthful character of highly poisoned water. It is perhaps enough to say that a chemist is not of necessity a sanitarian, nor is his work the most important basis upon which a sound or safe conclusion is built as to the proper hygienic value of water for potable uses. This certainly shows the folly of making a chemical standard of purity for such waters, until at least greater certainty is attained in such examinations.

XIV.

GLUCOSE IN ITS SANITARY ASPECTS.

By PROF. WM. H. BREWER, YALE COLLEGE,

PRESIDENT OF THE BOARD OF HEALTH OF NEW HAVEN, CONN.

Glucose is the common name for the sugar made from starch. It is chemically formed by the action of dilute acids and heat on any kind of starch, and the commercial product may be greatly varied in character by variations in the processes of manufacture. In commerce the term "glucose" has come to mean usually the liquid and "grape sugar" the solid kinds. Numerous trade names are in use for special kinds, such as "mixing glucose," "mixing sirup," "corn sirup," "jelly glucose," "confectioners' crystal glucose," for liquid varieties, and "solid grape sugar," "clipped grape sugar," "granulated grape sugar," "powdered grape sugar," "confectioners' sugar," "brewer's grape sugar," "anhydrous glucose," etc., etc., for solid varieties; but with the public it is all *glucose*.

It has long been in commerce, but in this country it has come to be widely and popularly known only within the last ten years. During this same time many charges have been made against its healthfulness when used in food or drink. Many very sensational statements have been widely circulated in the newspapers, and much alarm has been created because of its alleged unwholesomeness. Its extensive use as an adulterant, where such use was a fraud, has further increased the suspicions against it, until there came to be a wide-spread belief that it was a serious danger to the public health; and consequently some states have passed special laws against its use in table sirups, and other enactments have been made against it. Furthermore, in Germany, where large quantities are made from potato starch, several investigators have claimed that when fermented (as in brewing) unwholesome products are found. Others have denied this, so there has been much uncertainty both with the public and with scientific men as to the actual facts.

In April, 1882, when a bill was before congress (H. R. 3,170) "To tax and regulate the manufacture and sale of glucose," the commissioner of internal revenue (Raum) asked the National Academy of Sciences to investigate the matter thoroughly, and report on "The saccharine quality of this product as compared with cane sugar or molasses, and also especially as to its deleterious effects when used as an article of food or drink, or as a constituent element of such articles." He placed at the disposal of the academy "numerous specimens of the article in question [which]

are in the possession of this office," and the committee chosen had ample powers given it to conduct the investigation satisfactorily.

The committee consisted of Professors Geo. F. Barker, chairman, Wm. H. Brewer, Wolcott Gibbs, Charles F. Chandler, and Ira Remsen.[1] They visited and examined in person certain glucose factories, sent a competent agent into many others, where he examined the processes and methods, and collected samples of the products for investigation in the laboratory, and still other specimens were purchased in the trade. The latter however were not abundant, as many of the more desirable articles for investigation could not be obtained in the open market. Articles supposed to be adulterated were also bought in the markets, and the investigation, both in the laboratory and in the literature of the subject, was much fuller than any ever before made. The committee finished their report late in 1883, and it has lately been published. This new investigation is my excuse for bringing so old a subject to the attention of this association, and of giving the incident circumstances at such length.

I say "old" subject, for the production of starch sugar on a commercial scale is not so new as is popularly supposed: hence a short sketch of its history will be in place here as a preface to its present status. I will omit all references, as the committee in their report have published very full references to the extensive bibliography of the subject.

The sugars are a particular group of chemical compounds, and several of them are articles of manufacture. The starch sugar of commerce consists chiefly of *dextrose*, with varying quantities of another kind of sugar called *maltose*, and often mixed with a little *dextrin*, or starch gum. The commercial material may be solid or liquid, according to the degree of conversion and process of manufacture and the amount of water left in it, the solid forms containing usually from four to fourteen per cent., and the liquid forms from that up to 25 per cent. There is an anhydrous form containing but half a per cent. of water. It is as white and crystalline as the purest loaf sugar, but its manufacture has not thus far been profitable, and it is not now in the market.

The *dextrose* of chemists is one of the varieties of sugar, best known as the sweetening principle of honey, grapes, and many acid fruits. There were formerly many attempts, which were more or less successful, to extract it from grapes on a commercial scale, and hence it early came to be known as "grape sugar," in distinction from "cane sugar" or *sucrose*.

Sugar was unknown as an article of commerce in Europe until after the Middle Ages. With the settlement of tropical America the cultivation of the cane greatly increased, but sugar remained a costly luxury until within the memory of many old people now living. In 1747 Margraff showed it was contained in small quantities in the beet and various other plants which grew in northern and central Europe, but no process was

[1]As bearing on the value of their conclusions, I may say that four of them are chemists of eminence, four of them have been prominently connected with special sanitary investigations, and two of them have had long experience as officials of boards of health.

devised for extracting it on a commercial scale until chemistry came to the aid of art.

So soon as chemistry assumed the dignity of a science, this costly and coveted luxury became the subject of investigation by scientific methods. In 1790 Tuhten extracted a sugar from honey, which Lowitz showed in 1792 to be different from the sugar from cane. In 1797 Achard devised a process for the extraction of sugar from beets. In 1803 and 1806 Proust published on the sugar in grapes, and between that date and 1810 Bouillon, Dombasle, Lagrange, Montalivet, Parmentier, and Vogel experimented and published on the extraction of sugar from grapes, and "grape sugar" became a familiar term. The latter year Deyeux showed the difference between grape sugar and real (cane) sugar. By this time it came to be well demonstrated that nature produced various sugars, differing in chemical composition, in physical characters, and in degrees of sweetness. Numerous processes had been devised or suggested for extracting them from the natural substances grown in Europe in which sugars existed chemically ready formed, but none of the processes were economically satisfactory.

The next year, 1811, Gottlieb Sigismund Kirchhoff, a Russian chemist, discovered that sugar was produced by the action of dilute acid on starch with moderate heat. This discovery had an especial importance just then. It was the period of the Napoleonic wars. Sugar, a costly luxury before, had become much more so now, and sometimes the price rose to above a dollar a pound. The very high prices had stimulated the experiments, already alluded to, for the production of sugar from grapes and other European products. But here was a startling discovery in chemistry. Heretofore all the sugars known were produced by nature chemically ready formed, only mixed with grosser materials. But this produced it artificially. Kirchhoff's discovery was published early in 1812, and before the close of that year various chemists had experimented on it, and papers were published in several continental languages. The new sugar was supposed to be identical with cane sugar, and, stimulated by the high prices and great scarcity of sugar during the blockade of the continental ports, manufactories sprang up in various countries. Soon immense quantities of starch sugar were produced, and the cultivation of potatoes, which had gained headway but slowly as a food plant, rapidly increased as a source of starch.

Chemists soon demonstrated that it was not the same as real or cane sugar; consumers found its sweetening power was much less, that it was much inferior and not nearly so well adapted to many uses. Napoleon fell in 1815; peace followed, the blockade of the sea-ports was raised, and again cane sugar came in from the colonies; prices fell, and the manufacture of starch sugar rapidly declined. There were strong efforts to continue the manufacture and use the product in brewing and for increasing the strength and quantity of wine; but in spite of all this the manufacture, as an industry, practically disappeared.

It did not, however, absolutely and entirely go out of existence; some

demand for it continued, chiefly in brewing and for making confections. After a period of depression the manufacture slowly increased again, and has now assumed greater proportions than ever before.

We have no continuous statistics of production, but there are some statements for particular periods. Payen, in 1855, placed the production in France at 5,500 tons annually. According to Wagner there were 60 glucose factories in the German empire in 1874, producing 19,800 tons of sirup and 27,500 tons of solid sugar. Post places the production in Germany for the fiscal year of 1877–'78 at 5,931 tons of sirup and 8,135 tons of solid sugar, this being the product of 45 factories. Wagner's Jabreshericht der Chemischen Technologie for 1877 says that 2,221 tons were used in Germany the previous year in the manufacture of beer, and the volume for 1882 gives a total of "production of starch sugar in the German Customs Union for the fiscal year 1881–'82," from which it appears that the production of grape sugar (solid) was 18,384 tons against 11,768 tons the previous year, and of glucose (liquid) as 18,782 tons against 17,970 tons the previous year. There was also produced in these years 1,711 and 855 tons of "color" sugar, the nature and use of which I am not acquainted with.

It will be seen from this that the manufacture of glucose has gone on in Europe about seventy years, and continues to be an industry of great magnitude, although subject to great fluctuations. It is made from potato starch, and both French and German sorts continue to be imported into this country to some extent for use by confectioners.

From time to time the manufacture of starch sugar (usually for sirups) was attempted in this country, corn being the raw material. I know not how early this begun, but in 1849 I saw a very nice article of sirup which was then being manufactured, and I have heard of earlier attempts.

In 1864 two patents were taken out in this country for improved processes for making sugar from starch (many have been issued since), but it was not until within the last ten years that the manufacture has assumed any considerable importance: since then it suddenly assumed immense proportions.

The "Census Bulletin," No. 304, gave then seven glucose factories, the gross value of whose products amounted to about five and one half millions of dollars. According to Prof. Wiley, there were ten glucose factories in the United States on August 1st, 1880, converting daily about 20,000 bushels of corn. It is probable that in that year from four to six millions of bushels of corn were converted into sugar, and the next year probably ten or twelve millions of bushels. In 1883 the academy committee reported thirty-two manufactories, representing an aggregate capital of about five millions of dollars, with a capacity of 500 to 12,000 bushels per day. The total production is very difficult to estimate, but the committee estimated the total capacity at an average of 40,000 to 45,000 bushels of corn per day. The production, however, is subject to great fluctuations, due to the changes in the relative prices of corn, barley (or malt), and the products in which glucose is used, and a great

falling off has taken place since that date. Its manufacture usually is associated with that of starch, the two going on more economically together in a fluctuating demand.

The sanitary aspects of a material which goes into foods and drinks in such enormous quantities is one of profound importance, and justified the investigation ordered by the revenue department.

Starch sugar is used for nearly all the purposes for which cane sugar is used, and for several others besides. It is a constituent of most of the table sirups found in the markets of the older states, often to the extent of more than one half; it is used as a substitute for cane sugar in confectionery, and in canning fruits and in making fruit jellies; it is used as an adulterant of cane sugar (but to a less extent than many have claimed), also as an adulterant for honey, and for many other uses where a sweetening principle is needed. In many of these its use is perfectly legitimate and honest; in others, an unmitigated fraud. In all the cases mentioned it goes into the food as sugar, but there is an enormous consumption where only the fermented products are taken into the system, particularly in beer and ale. Some is used in the production of wines, and some is fermented into vinegar; but these uses are trifling in quantity compared with the enormous amount used in brewing.

No one claims that the grape sugar (dextrose), produced by nature in honey, grapes, or other fruit, renders food unwholesome. Moreover, as cane sugar as well as starch is changed to grape sugar by the action of weak acids and heat, it (dextrose) must often be formed artificially in the ordinary processes of cookery, in the preparation of various common foods, and no one claims that the public health is endangered thereby.

If, therefore, the commercial article made from starch is unwholesome and a source of danger, it must be due to one of two causes. Either unwholesome impurities are left in the product in the manufacture, or else injurious fermentation products are produced when glucose is used in brewing or similar fermentation.

To determine the first, many analyses were made of materials either obtained from the glucose factories or bought in the market. Of nineteen samples coming from eight or more factories, fourteen contained less than one half of one per cent. of ash, and this ash consisted almost entirely of the sulphates and chlorides of lime, magnesia, iron, and the alkalies, substances found in the ashes of ordinary plants, only in different proportions. Neither copper, tin, nor other metallic impurities were found in any of the samples, although specially looked for, because during the past few years statements have been widely circulated of metallic compounds in injurious quantities being found in glucose. After examining the processes of manufacture in various establishments, and after analysis of the products, the committee found no reason to believe that injurious impurities were left in the commercial product from the methods or processes of manufacture.

In Germany, where large quantities of starch sugar from potatoes are used in brewing, some experiments have been published showing that

after the fermentation injurious substances are found in the fermented products, either as the result of fermentation, or else left in from the manufacture. Other experiments conflict with this : so, even there, the matter is still in uncertainty. Even if true of the product from potatoes, it might not be true of glucose from corn ; so Prof. Remsen of the committee made an extensive series of fermentation experiments on a sufficiently large scale to give satisfactory work. Many interesting details regarding these experiments have not been printed, but the report is sufficiently full for an understanding of the matter, and the published conclusions contained are, that "There was nothing whatever to indicate that the extracts contained anything injurious to health ; and the conclusion seems to be fully justified that the examples examined by us, and which we have every reason to believe were fair average samples of the substances found in the markets, contained nothing objectionable from a sanitary standpoint." The extracts mentioned above were the concentrated residues obtained by evaporating the fermented products, and which were taken, in their concentrated form, into the systems of the experimenters without ill effects.

It must be kept in mind that these experiments were with American glucose made from corn, and they neither deny nor confirm the conclusions of German chemists as to the result of similar experiments with the starch sugar from potatoes, which belongs to a natural order of plants containing alkaloids not found in grain. It must also be remembered that these experiments are conclusive only on the matter of specially injurious substances being found in the products of fementation, and have nothing to do with the quality of the beer (or other fermented liquor) made entirely or in part from glucose. That is a matter for beer-drinking experts to settle.

The conclusions reached by this committee were, that American starch sugar is reasonably pure ; that it contains no specially injurious substances, either in its normal condition or when fermented ; and that, though having but three fifths the sweetening power of cane sugar, it is in no way inferior to it in healthfulness. Considering the magnitude of its production, and the quantities and range of consumption, this is a most comforting conclusion.

XV.

ADULTERATION OF BEER.

By PROF. H. B. CORNWALL,
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It is almost universally admitted that the use of pure ale, beer, and similar malt beverages, is at times beneficial for delicate persons, while even their habitual moderate use is by many claimed to be beneficial in general, even to the healthy individual.

Alb. Schmidt (*Archiv der Pharmacie*, 1878) says,—"Whatever may be thought of the nutritive value of beer, it is unquestionably to be removed from the class of luxuries and placed among the agents of nutrition; because the happy combination of refreshing, thirst-quenching properties of normal beer, with a moderate nutritious effect (through the carbonic acid, on the one hand, and the extractives, dextrine, sugar and salts, especially the phosphates, on the other), render it a refreshing and strengthening beverage."

Stillé and Maisch (*National Dispensatory*), after enumerating various ailments in which the hop exerts a peculiar beneficial action owing to the association in it of a bitter tonic with a direct sedative of abnormal nervous action, add that a pure and strongly hopped beer contains all the virtues of this agent. Unfermented malt extracts are largely prescribed for delicate persons.

Even so cautious a writer as Parkes (*Manual of Hygiene*, 5th ed.) does not seem to deny that beer may serve a useful purpose as a beverage, although he raises the question whether it is not an expensive agent for the supply of carbohydrates, salts, and a tonic (if needed) to the system.

This is not the place, however, to discuss the question whether malt beverages are, in general, injurious to those who consume them. The writer proposes rather to accept the fact of their wide-spread use, and to discuss the question whether there is reason to believe that they are ever prepared in such a way as to contain positively injurious constituents, or to lack in part some of the important ones.

Beers, including all ordinary fermented malt beverages, consist essentially of alcohol, organic extractive matter, and salts, with water. Their nutritive value depends largely on the extractives, while the salts, especially the phosphates and potash in them, may be regarded as playing an important rôle in nutrition. The extractives contain nitrogenous matter as well as carbohydrates. Whatever process of brewing tends to considerably increase the proportion of alcohol as regards the nutritious extrac-

tives and useful salts, lessens the nourishing power of beer and increases its intoxicating power, and is in so far to be deprecated. The use of any materials is to be discouraged which are employed for the sake of cheaply producing a beer that may indeed be satisfactory to some consumers, but which is especially liable to deteriorate, and which is therefore (a most important point) especially liable to be consumed in a deteriorated state. The use of any means to give to a beer, really deficient in certain esteemed properties, the semblance of a beer known by experience to possess those properties, is to be discouraged.

On the other hand, any alterations of old processes which will more cheaply, and therefore more surely, secure all the useful properties of a beer, are to be encouraged by reasonable men, so long as the beer shall be used at all.

We hear much about the adulteration of beer; and those who take the trouble can readily find, on the other hand, men ready to assert that beer is not adulterated; that injurious substitutes for hops and undesirable substitutes for barley malt are not used, but that whenever beer is bad the fault lies in the manufacture and handling, and not in the materials employed.

The writer proposes in future to attempt an investigation of this subject by actual analyses, having already made some progress in this direction. The present paper, however, is intended rather to place the question before this association than to answer it from personal experience; and with this end in view evidence collected from various sources will be given. It is evidence worthy of careful attention.

First, as to the evidence against injurious sophistications. A few years ago the "Business Men's Moderation Society of New York" sent out a circular, addressed to the beer brewers of New York city and vicinity, and obtained answers of which the sense is given below,—the answers being signed by members of the "Association of United Lager Beer Brewers of New York City and Vicinity," who expressed their readiness to make oath as to the truth of the answers.

The only substitutes for barley malt used were corn meal, corn starch, rice, grape sugar, and glucose, in proportions varying from 5 to 20 per cent. The brewers using any of them proposed to discontinue their use whenever it was shown that they were adulterations or deleterious. Neither molasses nor any substitutes for hops were used.

Although the questions were usually of a very specific nature, and the answers seemed to relate especially to the substances named in the questions, yet it would appear that the brewers intended to disclaim the use of glycerine, liquorice extract, or any other sweet substance. In answer to a note asking their reasons for using any substitutes for barley malt, they asserted, among other things, that some brewers add grape sugar (or glucose) to strengthen their wort, thereby avoiding the necessity of concentrating it by evaporation, which might caramelize the sugar and make the beer too dark. They add that glucose costs at least as much as barley malt: but this part of the answer does not directly touch the ques-

tion whether they do not secure a certain alcoholic strength in their beer more cheaply by using glucose. Farther on in their answer they do say that the malt substitutes used are not employed for the purpose of cheapening the beer produced, but for making desirable variations in color and flavor,—the addition of any of these substances making a lighter colored beer than malt alone, and each one varying the flavor. Those brewers who use them believe that they thus make a better beer, and know that it suits the taste of their customers,—an object with all successful manufacturers. They add, that none of these substances are cheaper than malt, unless it be the corn meal or prepared corn. In regard to these assertions about the cost of materials, it may be said that the experience in Germany does not sustain the position taken by the brewers above.

A most positive denial of any injurious sophistication in Germany is made by H. Rüdinger in his *Bierbranerei*, 1876. After asserting that the cases of illness so often attributed to beer are due either to excess, or to the use of young, incompletely fermented beer, he continues as follows: "It is frequently asserted that many breweries economize in hops by using other bitters not conducive to health. By some it has been asserted that the fearful poison, strychnine, and the poisonous picric acid, have been used. Unfortunately it too often happens that nonsense once written is copied thoughtlessly by hundreds, and in this way spreads among the masses." He then argues that no brewer would dare use such poisonous substances, and, while admitting that quassia and gentian might be used, asserts that the sense of taste is here a sufficient safeguard—a conclusion to be accepted with much reserve. He continues,—"It is well to remember that the quantity of hops used for the most strongly hopped beer is small, so that even if the price of hops was very high the increased cost of the beer could be offset by slightly diminishing its strength or lessening the quantity of hops used, without any necessity on the brewer's part of employing foreign bitters, which would certainly ruin his reputation, because the fact could not long be concealed. We are therefore happily able to say that beer is a beverage which always reaches the market in a pure condition, because it admits of no adulterations which cannot immediately be recognized by the taste, and detected with certainty by the chemist."

It would not be difficult to point out several weak spots in the argument which brings Herr Rüdinger to so pleasant a conclusion. For instance, Would not the fame of a brewer suffer if he put forth a weak beer, insufficiently hopped? And again, as to his statement that no brewer would dare to use poisonous hop substitutes, it is only necessary to notice that in the *Analyst*, Sept., 1884, may be found a report by Dr. Waller, of the detection of Martius yellow as a coloring matter added to several specimens of mustard. Edson's experiments indicate that the dye is a strong irritant poison, it having proved fatal when administered to large dogs in moderate doses, 15 to 49 grains killing dogs weighing 50 pounds.

The Brewer's Association of Germany used the following language:

"Beer and its adulterations excite of late much public interest. The majority of the public press does not fail to spread abroad the belief that much of the beer consumed is adulterated, and utterances from high places have done much to increase the mistrust of everything called beer. It is vain to fight this with words, because it has been often shown that, in spite of the many accusations, actual instances of beer adulteration are rarely met with."

Hager (*Chemisches Centralblatt*, 1877), after claiming that the use of box as a substitute for hops is perfectly innocent, asserts that instances of the employment of cocculus indicus, colchicum, and spurge laurel, with other injurious hop substitutes, exist probably only in treatises on beer analysis.

The writer had an interview with the secretary of a prominent Brewer's Association, in which it was confidently asserted to him that the brewers in the vicinity of New York did not use any hop substitutes, and were governed in their partial use of malt substitutes by their desire to suit the varying tastes of their customers, barley malt being the cheapest material at their commaud. The addition of a little bicarbonate of soda to beer was admitted, with the explanation that it was done to suit the palates of consumers.

Second. The evidence that beer is occasionally adulterated, sometimes with very injurious substances, is very strong. The adulterations may consist in the use of objectionable substitutes for malt or hops, or in the addition of chemicals and other ingredients to strengthen a badly brewed beer, or to correct its taste.

Donovan (*Domestic Economy*, Vol. I), so long ago as 1830, states that cocculus indicus, aloes, wormwood, quassia, gentian, and other articles were used to doctor porter. The importation of 300,000 pounds of aloes into England during the first four years of British possession of the Cape of Good Hope aroused suspicion. Donovan further asserts that liquorice, treacle, mucilage of flax seed, potash, lime salts, and a variety of other substances, were kept on hand by brewers, until the law interposed and forbade the use of anything except malt and hops. It may here be remarked that the British brewers are no longer so narrowly confined in their choice of materials.

Dr. Ure is quoted by Watts (*Dictionary of Chemistry*, 1868) as saying that "As long ago as the reign of Queen Anne brewers were forbid to mix sugar, honey, guinea pepper, essentia bina (burnt wort), cocculus indicus, or any other unwholesome ingredient in beer, under certain penalty, from which we may infer that such at least was the practice of some; and writers who profess the secrets of the trade mention most of these and some other articles as essentially necessary. . . . . .
The following is a list of some of the unlawful substances seized at different breweries and brewers' druggists' laboratories in London, as copied from the minutes of a committee of the House of Commons: Cocculus indicus multum (an extract of cocculus), coloring, honey, hartshorn shavings, Spanish juice, orange powder, ginger, grains of par-

adise, quassia, liquorice, caraway seeds, copperas, capsicum, mixed drugs."

Watts comments on the above as follows: "This appears at first sight a rather formidable picture of adulteration: nevertheless most of the articles enumerated above are perfectly harmless, and of those which are really injurious the use appears to have very much declined, partly in consequence of the improved taste of consumers. Formerly there was a preference for what was called good hard beer,—that is to say, beer in which nearly all the sugar and mucilage had been converted into alcohol by fermentation: hence the use of sulphuric acid to simulate the taste of beer thus advanced in fermentation. . . . Picric acid and cocculus indicus are sometimes added to give bitterness to beer, especially to bitter ale. The latter of these substances is especially objectionable, as it contains a very poisonous substance, viz., picrotoxin."

Schmidt (*Chemical News*, March 12, 1864) states that the attention of the police having been drawn to the importation of large quantities of cocculus indicus to St. Petersburg, it was found that this berry was used to adulterate certain drinks, but especially beer.

Blyth (*Manual of Practical Chemistry*) says that picric acid has certainly been found in beer.

Wagner (*Jahresbericht*, 1877) reports that Griessmayer found absinthine in a beer; and Kirchmann says he found that, about 1857, the brewers near Weimar were using *heracleum spondyllium* (cow parsnip) as a substitute for hops.

Rauwetz (Wagner's *Jahresbericht*, 1865) found aloes in the residue that had settled from an otherwise excellent beer.

Soubeiran (*Falsification des Aliments*) states that it was established, in a discussion of the Academy of Medicine in Belgium in 1872 and 1873, that the Belgian brewers not uncommonly used cocculus indicus to economize both malt and hops. His further statement, on the authority of P. L. Simmonds, that the 250 tons of the berry imported annually into England are used by brewers chiefly, must be taken as referring to continental brewers, if Flückiger (*Pharmacographia*) is correct in his assertion that nearly the whole of the English importation is shipped to the continent.

Parkes (*Manual of Hygiene*) says with regard to cocculus indicus, "It is not known whether much of this is used now. The witnesses, examined some years ago (1856) by the committee of the House of Commons, all doubted it. A large quantity of cocculus indicus is, however, annually imported, and no other use is known." Parkes states that in two instances out of twenty specimens of adulterated beer, analyzed in 1863 by Mr. Phillips, cocculus indicus was found in large quantities. Tobacco was found in one.

A Schmidt (*Archiv der Pharmacie*, XII, p. 392) divides the adulterations of beer into two classes: the use of correctives to restore a spoiled beer, and the use of substitutes for malt and hops. He continues substantially as follows: Probably most of the evils arise from a too sparing

use of the proper materials to furnish a strong and therefore durable beer. The beer, weak in alcohol and extract, grows sour, and the acid is neutralized with alkalies and chalk. It must also be clarified, and to conceal its bad taste may be treated with glycerine, which probably would rarely be used merely as a substitute for malt, because it does not undergo alcoholic fermentation.

Schmidt gives a long list of the substitutes for hops, and states that, although the use of some of them has been proven, yet their use is much less common than is supposed by some. He distinctly asserts that glycerine and alum are added to beer; that bicarbonate of soda is used in unwholesome quantity; and that the use of glucose is to be deprecated, because it deprives the beer of useful phosphates and albuminoids. He alludes to the travels of beer chemists who visit the breweries of South Germany to cure ailing beer, and maintains that the many complaints against adulterated beer cannot be regarded as groundless suspicions.

The law courts have furnished evidence of the adulteration of beer. In Upper Bavaria, in 1877, a brewer was fined for adding glycerine to his beer to improve its taste. Again, in Bavaria (*Zeitschrift für das Chemische Grossgewerbe*, Vol. 4) in one year three brewers were fined for adding glycerine, bicarbonate of soda, and sulphuric acid to their beer.

Two publicans were fined in England (*Analyst*, Vol. IV) for adding salt to beer, 66 grains of salt per gallon being found in one case and 98 grains in the other. Another publican was fined for adding refuse brown sugar to his beer.

In the *Encyclopædia Brittanica* (9th ed.), it is stated that in 1872 only six samples of the beer tested in the Inland Revenue laboratory were found to be adulterated. Dangerous adulterants were found, but only in the case of beers brewed on a very small scale.

Out of twenty-two Bavarian beers tested in Berlin under police supervision (*Zeitschr. für das Chem. Grossgewerbe*, Vol. 2), none were found to contain poisonous principles, but eleven were said to contain foreign innocuous bitter principles.

Occasionally a brewer may unwittingly introduce some adulterant into his beer. Thus, Haffstedt (*Chem. Centralblatt*, 1876) reported the discovery of a foreign bitter principle in a beer at Upsala, Sweden. The brewer protested that this was impossible, since only hops had been used. On investigation it was found that the hops had been treated with extract of wormwood. The adulteration of hops is no new thing.

From the foregoing it appears to be proven that the adulteration of beer is not unknown, and sometimes directly injurious substances are used. Moreover, the explanation so often made that the chief adulterants are either in themselves harmless or are even constituents, to a certain extent, of genuine beer, ought not to be too readily admitted. Water is a constituent of milk, but its addition to milk is not on that account to be excused.

Let us consider now the effects of the use of acknowledged malt substitutes, and the testimony in regard to them. It appears to be well

established that a well flavored and nutritious beer may be brewed from barley malt with a small addition of rice. A. Metz (*Chem. News*, Dec. 23, 1870) gives the following comparison between the analysis of a malt-rice beer and the average of 21 Bavarian beers.

MALT-RICE BEER.		BAVARIAN BEERS.		
		Average.	Maximum.	Minimum.
Alcohol,	3.65	3.55	3.98	3.23
Extract,	7.36	6.17	6.61	5.42
Sugar,	1.63	1.08	1.38	0.82

The rice beer was brewed at Weisenau, near Mayence, from five sixths malt and one sixth rice. It was clear, pale, of a pleasant mild taste, and foamed strongly, but retained its carbonic acid well.

J. Hanamann (*Jour. Chem. Society*, London, 1876) says,—"It is a well known fact that in the brewing of beer useful constituents are lost, and this circumstance, combined with the continual rise in the prices of barley, hops, labor, and duties, has induced brewers to ventilate the question whether a portion of the above substances might be replaced without detriment to the quality of the beer. . . . At present maize (corn) constitutes the chief substitute for malt, but it is used secretly on account of the prejudice against it. . . . By the use of starch sugar large quantities of gypsum are sometimes brought into the wort, which gives the beer a peculiar bitter taste. . . . Albuminous substances give to beer not only its flavor, but likewise its nutritive properties, and are therefore of great physiological importance. Hence purified starch is the least suitable substitute for malt. Rice might be better, but maize would answer best. Beer prepared from maize malt easily turns sour."

Hanamann gives the following analyses of fermented worts, pure malt with 40 per cent. of each substitute being used in every case.

	Pure malt.	Maize malt.	Rice malt.	Starch malt.
Alcohol,	2.71	2.76	2.9	3.19
Sugar,	1.05	1.12	0.98	0.35
Dextrin,	4.54	4.31	4.42	4.74
Extract,	6.59	6.48	6.25	5.91
Proteids,	0.43	0.39	0.33	0.28
Other substances,	0.57	0.66	0.52	0.54

He concludes that other grains may be properly used as substitutes for barley malt.

L. Häcker (Wagner's *Jahresbericht*, 1872) says,—"On account of its cheapness maize is the best substitute for barley malt, and it also agrees better with malt in chemical composition, especially as regards the proportion of nitrogenous and non-nitrogenous matter."

Probably the position taken by a conservative body of brewers on the subject of malt substitutes will best answer the question as to their desirability. The German Brewers' Association, meeting at Frankfort, declared that a wholesome beer is only to be made of hops, malt, yeast, and water, with a partial replacement of the malt by starch meal, admitting rice, corn, and sugars made from starch. The desirability of using starch and sugars is, however, still questionable, in the writer's opinion.

The Bavarian law excludes all substitutes for malt and hops, to the mutual satisfaction of consumers and brewers. The law, however, exists not only for hygienic but also for fiscal reasons, Wagner stating that the state retains the law largely for the sake of its revenue.

The Frankfort meeting further expressed its views thus: The use of certain substitutes for malt can be defended on scientific and hygienic grounds. The addition of some rice permits the manufacture of a finely flavored beer, preferred by many to pure malt beer. Nevertheless, the beers most favorably known throughout the world are brewed only from malt and hops, while substitute beers are in general inferior to pure malt beers. The consumer has therefore a right to know what sort of beer is furnished to him. For these reasons the Association recommended that, except in Bavaria, other amylaceous substances, to be especially designated, may be partially substituted for malt, and that substitute beers be sold by their characteristic names,—rice-beer, sugar-beer, potato-beer, etc.

The use of certain grains as partial substitutes for malt, if not carried to too great an extent, is probably unobjectionable. The same cannot be so surely said of grape sugar, glucose, or starch. The grains contribute a nourishing extract, but the fermentable sugars only increase the alcoholic strength of the beer, and however much this may be to the taste of some consumers, it seems certainly to be at the cost of very valuable properties in the beer.

The following appear to be most judicious resolutions: they were adopted after an exhaustive discussion at the International Congress of Medical Sciences at Brussels, Sept., 1875 (*Archiv der Pharmacie*, 1876),—

1. Only those fermented beverages are truly beers which are made from grain and hops.

2. No other substance can replace these, either wholly or in part.

3. All substitutes are to be regarded as deceitful adulterations, and should come under penalty of the law, even when not injurious to health.

Thus far we have considered mainly the use of malt substitutes which are intended to undergo fermentation, being added to the unfermented wort; but raw sugar and glycerine have been shown to be added sometimes to the fermented beer, to give it body and sweetness, or to conceal some unpleasant taste. The practice has never been openly defended

because it is manifestly incapable of an honest defence, and is to be regarded as a serious adulteration.

The question of using preservatives may be best presented by the just view taken by the Frankfort meeting, as given in Wagner's *Jahresbericht:* "While preservatives may be and have been profitably used in preparing export beer, yet the mere fact that such preservation is possible offers an inducement to the brewer to use them unnecessarily. It is probable that their use will extend more than is desirable, and therefore the association recommends that their use in beer be forbidden." This is eminently reasonable. Only ignorance or carelessness can make preservatives necessary; they are liable to great abuse; and, as Dr. Wm. K. Newton remarks (*Sanitary Control of Food Supply*, read at the last meeting of the American Public Health Association), "their use should be discouraged by sanitarians; for the mere fact that a certain chemical combination will check fermentation or putrefaction outside of the body leads us to believe that digestion will be impaired or impeded. This I have sought to prove in an imperfect way by treating milk with a preservative, and then attempting artificial digestion. Digestion was proved to be interfered with, or checked altogether."

Finally, the possibility of dangerous metallic contamination, from the frequent practice of drawing beers through lead pipes, must not be overlooked.

The writer believes that adulteration of beers by the addition of brown sugar, glycerine, bicarbonate of soda, common salt, and other substances, to improve the taste or appearance of indifferent beers, is not uncommon abroad; also, that the use of even so apparently innocent a substitute for malt as glucose, grape sugar, or starch, is, so far as we now know, undesirable or of doubtful propriety; and, finally, that hop substitutes, not always harmless, are used, although not so commonly as is supposed by many. The evidence supporting these views is incontestable, and he proposes to investigate the subject personally as regards American beers. To this end he invites the coöperation of any members of the association, or other persons interested in the subject, and to examine any suspicious beers, which may, after communication respecting them, seem proper objects of analysis.

In concluding this paper it may be well to present a few partial analyses of lager beers, made at Princeton, N. J., for the State Board of Health of New Jersey, and for the writer, by Dr. L. W. McCay. The first ten have been already published in the report of the Board of Health for 1883. No foreign bitters were found.

Sample.	Specific gravity.	Alcohol—per cent.	Extract—per cent.
1	1.0155	4.11	5.6
2	1.0124	4.25	5.0
3	1.0093	3.52	4.4
4	1.0136	4.47	5.3
5	1.0188	4.64	6.7
6	1.0227	4.29	7.5
7	1.0175	5.16	6.5
8	1.0265	4.58	8.6
9	1.0191	3.94	6.5
10	1.0153	3.88	5.5
11	1.0206	3.11	6.5
12	1.0205	4.41	7.0
Average, .		4.197	6.26

Of the above beers, Nos. 4, 8, 10, and 11 are well known brands of native beer, all but No. 10 being bottled beers. No. 12, also a bottled beer, together with No. 10, was kindly sent to me at my request by F. Hollender & Co., New York. All of the others were purchased for analysis. Of the draught beers, several were inferior and often too sweet. The most important result of the above analyses is the apparent indication of the use of grape sugar or glucose in preparing most of the beers, since it is difficult otherwise to explain the rather high amount of alcohol in proportion to the extract. The alcohol and extract were determined by Balling's indirect method (*Archiv der Pharmacie*, 1878), which gives the alcohol slightly too high in general.

Hurte (*Analyst*, Vol. VII) has given the results of analysis of four American bottled lager beers, showing also a high average of alcohol, as seen below.

	Milwaukee.	Lieber's.	Maus's.	Schmidt's.
Spec. gravity, . . .	1.0174	1.0229	1.018	1.0172
Extract, ...	7.312	5.988	6.33	5.816
Alcohol, ...	5.35	9.99	5.38	4.64

XVI.

THE ULTIMATE OF SANITATION BY FIRE.

By J. M. KEATING,
Memphis, Tenn.

In 1879 I had the honor, through the New York *Herald*, to present some reasons for consideration by the public that were by that paper indorsed as conclusive why cremation must be adopted as the ultimate of sanitation; and this association was kind enough to indulge me with time for the consideration and debate, and space in the published volume of its transactions for 1882, to give very briefly some reasons why excreta and all household wastes should be cremated. To-day I return to the same subject, reinforced by a growing favorable public sentiment, and strengthened by what has been accomplished, in part at least, in the direction to which sanitation tends as a finality of the questions of the disposal of sewage and house and street wastes. I ask the indulgence of the association, therefore, while I briefly pass in review some of the complaints as to the unsanitary condition of many of the cities and towns of Europe and Asia, as well as of our own country, for the purpose of merely suggesting the glaring defects of present systems, even the best of them, notwithstanding the careful supervision of officials, the force, in some cases, of almost sumptuary sanitary laws, and the favorable disposition of healthy-minded people, anxious to promote the highest sanitary purposes. By this review I propose to prove, and make plain, that when the people do not complain of polluted water, as they have to do in most cities, they do of sewer gas; that when resting seemingly secure in an approximately good system of sewerage (like that of Waring), they have to complain of the means for and methods of sewage disposal; that by the London method, so exhaustively expensive, the Thames is still nothing better than a wide, open sewer; that the Paris method is only partial, and too expensive and altogether impossible for large cities; that by the New York method the docks are filled with excreta, and the entrance to the harbor is threatened by bars formed of the street and house wastes, carried out to sea at great expense by barges; and that everywhere rivers are being destroyed by sewage that kills the fish, the poor man's free food crop, and makes what was once a source of health a permanent nuisance. I propose to prove that as privies and cesspools are condemned because they saturate the soil, sewers are to be condemned, in some instances for the same reason, and because they throw off and fill dwellings with sewer gas, and fill docks and harbors and rivers with

death-dealing sewage. In a word, I propose to prove that all present plans of sewage disposal are defective, because they are not final, because they merely contemplate the removal and not the destruction of what is conceded to be the prime factor in promoting and perpetuating, if not the originating cause of, much of the disease that decimates city and country alike. I propose to prove that cremation is a finality of sanitation, and that all other methods are so many make-shifts for the postponement of the evil day, which, when it comes, is by as many days of postponement or accumulation that much worse. We will, then, consider the present sanitary condition of a few of the cities of the world, as the facts have reached us during the present year from responsible sources, first taking those cities in Europe that for months during this year have been prominent for the prevalence of epidemic cholera, and two of which—Toulon and Naples—can only be matched for filth by the city and harbor of Havana.

Consul Mason, painting a picture of the condition of the harbor of Marseilles as a prime factor in the rise and progress of the cholera epidemic of last summer that cannot be ignored by wise and unprejudiced sanitarians, says,—

Both Marseilles and Toulon suffered terribly in the cholera epidemic of 1865. During the nineteen years since then, Marseilles has been, in several important respects, almost rebuilt. Her pavements, her sewerage system, her water-supply, and method of cleaning streets, removing night-soil, inspecting and regulating markets, her quarantine regulations and hospital facilities, are all probably unsurpassed in excellence by those of any European or American city. The old quarters of the city (ancient Marseilles), which were scourged so sharply by the plague in former centuries, have been pierced with broad avenues. Streams of pure water flow down the gutters, and the pavements of the principal thoroughfares are washed and swept with a care and frequency which leave nothing to be desired. The terrible lesson of former epidemics had been well learned by the municipal government, and long before the first rumor of trouble at Toulon, Marseilles was cleaned and made ready for the summer health; but with all the intelligent liberality which the city has evinced in the construction of her drainage system, there is an insurmountable difficulty which all the Mediterranean cities are alike compelled to face. Their sewers flow into a tideless and generally placid sea, and the harbor of Marseilles is almost entirely artificial. The old port is simply the estuary of a small creek, dredged out into a large dock, with a narrow outlet to the sea. The new ports are spacious harbors, enclosed by miles of piers and a breakwater, and deepened to navigable depths by dredging and excavations. Into these enclosed ports, which extend along two thirds of the shore front of the city, the entire volume of sewage is poured, and as there is only the surplus pure fresh water of the city hydrants to dilute this turbid flow, and as there is no tide to maintain the circulation of sea-water through the enclosed ports, the inevitable result is that the latter grow foul and pestilent. The same condition is unmitigated by equally vigorous sanitary measures that prevail. At Toulon it is thought it was the dredging of the disused dock there, during the months of April and May, which developed the seeds of the present epidemic.

The condition of Toulon is that of a pest-house inhabited by thousands of people, most of whom are so inebriated by the subtle influences of filth as to be beyond the reach of the appeals or efforts of sanitarians. The streets are narrow, the sewer system crude, defective, and inadequate to the wants of the population, and privies and cesspools abound, the

harbor itself being the largest and most dangerous of that last class of nuisances.

Naples, whose bay is a reeking pool of filth, is a nest of disease, infested by the most maliciously ignorant and besottedly bigoted people in Christendom. They are in the modern world, but not of it. They belong to the mediæval ages, and perpetuate their frenzied opposition to cleanliness, their pride in dirt, their preference for filth, and their reliance upon Heaven to furnish scavengers and save them from the consequences of their bestial habits. They are ages behind even the Chinese. The fires of Vesuvius might purify Naples—nothing else could.

Paris, long held to be the first city in Christendom in point of sanitary regulations and results, is in a most unsanitary condition. Mr. Clage, a well-known engineer, in a recent report, comments upon the dangers and nuisances connected with the privies and cesspools which still are connected with the great majority of the dwelling-houses. The sewer system is inadequate and defective, with a disposal system that is only partial, and never can be extended to satisfy the demands of the whole city. By a recent investigation, the results of which were published in the Paris *XIXe. Siècle*, the aspect of the Seine is declared to be that of a moving mass of vegetation, like the "sudd" of the Upper Nile, only that it is full of putrid matter not found in the Nile. This "sudd" converts the river into a morass of mud, the odor arising from which is indescribable. At St. Denis "the river boils under the action of the gases arising from it. Lumps of filth rise from the bottom, as in the Thames, and come to the surface, suddenly exploding and forming circles on the water, quickly effaced, but incessantly repeated. The Seine is nothing but an immense fetid mass of putridity, formed by chemical decomposition, the surface of which, all boiling with globules, shines in the sun."

St. Petersburg, with a population of nearly 1,000,000, and the high death-rate of 35.2 per 1,000, is without sewerage, and its water supply is taken from the river Neva, more or less contaminated by percolation from the subsoil.

Cairo, with a death-rate of 37 per 1,000, is supplied with water from the Nile, having no sewers, and the sewage filtering through the subsoil into the Nile above the water in-take.

Vienna, with a death-rate of 29.2 per 1,000, has an average of sixty people in each house, or twice as many as in Paris, while the ratable value of the houses in Vienna is only one sixth more than in Paris. Its sewerage system is defective, and privies and cesspools abound.

Pekin, with a death-rate of 50 per 1,000, is without proper sewerage, water-supply, street cleansing, or other modern sanitary arrangements. The bucket system prevails generally throughout China, and the contents are carried to the country, and there used as fertilizers. In some cities, as in Pekin, they have sewer-like receptacles for the excreta that are without current, and which once a year are opened, when the sewage is dipped up and carried to holes scattered through the most crowded parts of the city, and there dumped and spread out, and left to the slow process

of drying by the sun and deodorizing by the action of the atmosphere, the inhabitants meanwhile having all the horrible annoyances of the stench from the receiving-holes and the emptying sewers. The Chinese deem this process necessary to prevent fevers and the plague. Bad and forbidding as it is, it is not much worse than some of the so-called sanitary systems of Christian countries.

The report of the commission sent in 1880 by the United States government to Cuba, to make a sanitary inspection of the port and harbor of the city of Havana, is doubtless fresh in the minds of the members of this association. Wherever they went, in private as in public places, they found a total and utter disregard of even the plainest and commonest rules of sanitation, and a reckless invitation, in limitless filth, for all classes of decimating diseases prepared, even in the palace of the governor-general. The waters of the bay were long since condemned by British and American naval experts as little better than diluted sewage. Into it, ever since the first Spanish settlement, the excreta of a growing city has been dumped, and in some places it is to be found in banks and shoals, the stench from which at low tide is an ever-ascending protest against the daily additions to a nuisance that is the very bank where yellow fever perpetuates itself, and whence it has often spread to the United States.

New Orleans is without sewerage, though it has a population of 234,000, and an annual death-rate (in the absence of yellow fever) of about 33 per 1,000.

Schenectady, one of the oldest cities in the state of New York, is without any sewer system, and is suffering from the existence of thousands of privy-vaults and cesspools that have saturated the soil to a degree almost beyond cleansing.

Three fourths of the inhabitants of Hudson and Essex counties, N. J., one fourth the population of that state, drink the water of the Passaic river, taken from a point where the tide, laden with the sewage of 140,000 people, flows up and meets the downward current bearing the sewage and factory refuse of 60,000 people of other towns. In the face of this fact, Passaic, and a cluster of villages by the name of Orange, propose to add the sewage from 7,000 people to strengthen the decoction. The New York *Herald*, in a carefully prepared report, says that "it is not the sewage alone, and the dripping of 5,972 cesspools along the shore, and the refuse of tanneries, breweries, and bone-dust factories, that impart to the Passaic its unrivalled *bouquet:* it is the defunct animal kingdom, from the tiny kitten to the antediluvian tramp, found floating on its surface, that gives the water such a unique taste. Animals which die of some foul disorder are cast by the dwellers on the Passaic into the mighty sewer. Thus, carefully prepared statistics by indignant citizens show that during the months of July and August 1,789 adult cats, 9,311 kittens, 653 dogs and puppies, 118 sheep, 94 hogs, 5 tramps, 13 cows, 4 mules, and 7 horses, besides countless hens, geese, and ducks, sailed up and down on the tide between Newark and Dundee lake. Once the

river was the resort of many of the anadromous fishes. On the breaking up of the ice large numbers of the most delicious and delicate little smelts formerly ascended the stream and were netted on the reefs. Now none put in an appearance. The shad, too, used to be caught in vast quantities. They, too, have ceased to inhabit the river. Both above and below Belleville striped bass in their season afforded excellent sport for an army of anglers, but the water is now too impure for the fish's fastidious taste. Fish Commissioner Wright gives as a reason why catfish are but seldom caught, 'that the river is now chummed with too many dead cats and nigger children.' Even the grass-pike and sunfish have sickened of this rich diet, and recently there was a great mortality of water-snakes." To this last statement I invite the particular attention of my friend, the distinguished sanitarian, Dr. Bell, of New York, who, in the course of debate on my paper on "The Cremation of Household Refuse and Excreta," at the meeting of 1882, contradicted very flatly my statement that sewage killed the fish in the streams and rivers into which it is emptied, as it is into the Passaic. He will find also from this paper that the London commissioners say that the sewage flowing into the Thames has killed all the fish in that stream.

Salt Lake City, with a population of 30,000, has no sewers. The people are mostly supplied with water from wells and springs in the city, and mingled with the cesspools. In many cases the water in these wells is crawling with maggots, so they cannot longer be used, and the creek supplying the city with water is often filled with dead sheep.

In Trenton, the capital of New Jersey, the cesspool and privy-vault nuisance has grown to such proportions as to alarm the press. The *State Gazette* says,—"We store up the wastes in these horrible receptacles all about our premises, and even under our houses. There are premises in Trenton full of these glutted reservoirs of foulness, with no room for any more. Fancy the effects of living in the centre of such a cluster of accumulations of filth! The house connections with the cesspools are often without traps, and the deadly gas they generate pervades the home. They cannot fail to pour their reeking stenches into the air through the earth and other outlets. They pollute the very air we breathe."

Mr. H. F. Stanley, chief engineer of Cincinnati, complains that in that city, the largest on the Ohio and one of the oldest in the West, there are thousands of vaults, or cesspools, in use, which overflow into the street gutters, and oftener into the rugged ravines, where the filth is retained until it becomes unbearably offensive and prejudicial to health. Scores of these gulleys abound in Mount Auburn, Walnut Hills, and Price's Hill, which are rank with accumulated filth from the elegant residences in the immediate vicinity. There is not a ward with perfect drainage facilities in the city. The construction of sewers for the most part is good, but they are not sufficiently extended or connected to effect a perfect drainage of any portion of the city; besides which, the city's water-supply is derived from the Ohio river, from a point directly on the city's

front, where the water must be polluted by the drainage of a densely inhabited territory.

Onondaga creek, which flows through Syracuse, N. Y., receives all the refuse and sewage of the city, and is consequently a perfect Stygian pool; and yet Syracuse is regarded an exceptionally beautiful city.

The new sewers of Norfolk, Va., empty into the Elizabeth river, which is subject to tidal influences. In a few years it will be as bad as the East river of New York, and will have to be dredged of its accumulations of filthy silt; but before that is done, it will assert its strength as a nuisance, as it does in New York.

The sewers of Saginaw are emptied into the Saginaw river below the water-works, but in seasons of high water are liable to be submerged, so that the sewage will be driven back into deadly accumulations like those complained of in the main sewers of Detroit.

Yonkers, N. Y., a village with an exceptionally intelligent and cultured population, has its atmosphere burdened with the stench from the Nepperhan river, which, as described by the state board of health, is nothing better than an open sewer; and the proposition is seriously entertained by the mayor (a physician), the health officer, and the people to cover it in and make it the main sewer of the village, and drain it into the beautiful Hudson.

The water supply of Washington, hitherto regarded as exceptionally good, is being polluted by the farmers of Maryland and Virginia bordering on the Potomac. The health officer of Washington reports that recently, within a stretch of a few miles, not far from where the Washington aqueduct taps the Potomac, 1,000 carcasses of cholera-poisoned hogs were found floating in the stream.

In Youngstown, O., on the Mahoning river, great difficulty has been experienced in getting the property-holders to make house and privy connections with the sewers. The board of health has used its utmost exertions to abate the old form of privy-vaults and substitute the dry-earth system. It is now meeting with partial success. Many houses also have small dry-earth commodes. It is the unanimous opinion of the health board, that for protection, efficiency, and cheapness, this plan far surpasses all other modes of disposal of privy contents.

The village of Geneva, N. Y., which has had water-works since 1797, is only now preparing for sewers. It is like nearly all the villages and towns of New York, and, indeed, of all the states, honeycombed with privy-vaults and cesspools, and its soil is saturated beyond the cleansing power of any sanitary appliances.

Sacramento, Cal., is honeycombed with cesspools and privy-vaults, but a sewer system has been suggested, the sewage to be precipitated, and the affluent to be used for irrigation, notwithstanding this system has been declared to be a failure wherever tried.

In Chicago, in order to economize the excretal matter in a badly decomposed condition as taken from the catch-basins, it is dumped into vacant lots in order to fill up, and many houses are built on such stuff.

The *Sanitary News*, condemning this filthy practice by ignorant and reckless officials, tells of a "woman on the west side who spread a clean garment—a dress just washed—on the surface of the ground in the yard back of her house to dry. Soon after it began to snow; the garment was covered and forgotten until spring. It was then carried into the house, still frozen, and the process of thawing out begun. In a very short time it gave off an abominable odor, worse than that of the river when its sewer odors are most pronounced, which finally became unendurable. The garment was at once consigned to the alley. It had undoubtedly absorbed the gases generated by the 'fill-in' earth during the winter. Houses not only receive these gases when built upon such ground, but act as suction-pumps to draw them out." This, with the filthy Chicago river, nothing better than an open sewer, makes Chicago anything but a sanitarium. This river flows out into the lake, and, with favoring winds, is driven, a black, inky stream, across the crib, which is the in-take for the water-works. In an editorial in the *Journal of the American Medical Association* of August 16, on the "Importance of Pure Water," it is said that Lake Michigan supplies the water (for Chicago), and "when unpolluted by sewage, the lake water is remarkably pure and pleasant."

Toronto, which until 1874 was supplied with water polluted by the sewage of the city which emptied into the bay whence the water was taken, has just escaped a similar experience by extending a pipe from the old wooden conduit, a distance of 2,357½ feet into Lake Ontario. The water thus obtained is often muddy, but it is believed to be pure.

Marlborough, a thriving town in Middlesex county, Mass., has recently given up the old privy and cesspool system, and built sewers which are emptied into a small stream tributary to the Sudbury river, the source of Boston's water supply. The Boston *Herald* suggests that "it would not be money wasted if we were to maintain a corps of physicians in the country which makes up the water-shed of our water-supply, for the purpose of informing themselves, and thus warning the city of possible cases of dangerous pollution." Thus, notwithstanding the magnificent and costly intercepting sewer system, by long odds the finest work in the world, and so far the very best and safest in its results, Boston is threatened with disease by an insignificant stream poisoned by the excreta of a town that rejoices in thus being freed from a great nuisance.

Lynn, Mass., is constructing intercepting sewers, but the outflow is still a matter of advisement, owing to the currents of the harbor.

Detroit has a main sewer in which the deposit of decomposing excreta and street-washings is in places seven feet deep, the accumulation extending back more than a mile from the mouth. The *Medical Age*, commenting on this fact and the diseases resulting from such a mountain of filth, says,—"The water whence this city derives its drinking-supply receives between its source and our water-works the refuse matter and dejecta of nearly a million of people. At this point it receives the excreta of upward of 150,000 more, and then passes on and is drunk by the cities

between us and the seaboard." The particular attention of Dr. Wight, of Michigan, is invited to this last statement. He was a member of this association in 1882, when my first paper on this subject was read, and indignantly denied that Detroit had a foul water-supply. "There is no sewage in the water-supply of Detroit," he said. "It is taken from far above the city, and above any impurities in the river." I quote from the eighth volume of the papers and reports of the association.

Rockford, Ill., on the Rock river, a stream obstructed by a dam in the city, empties the contents of its main sewer into the river only two hundred feet below the in-take of the water-works, and a slaughter-house and half a dozen private sewers empty into it above the in-take, making a nice mixture of death and destruction.

Philadelphia complains of the pollution of the Delaware and of the Schuylkill, whence it gets its water-supply, and of its tributary streams, by the excreta of hundreds of thousands of people, and the wastes from woollen and other factories; and the *Medical News* complains of the foul condition of the sewers from the discharge into them of decomposing excreta and other organic matter.

Hartford, Conn., has a small stream which passes directly through it, and emptying into the Connecticut river, which carries down three fifths of the sewage of New Britain, with a population of 13,000, and also the sewage and drainage of the town of Newington. The stream is dammed twice within the city limits of Hartford, and again at the "stepping-stones" in Bushnell park in front of the capitol. Above the "stepping-stones" fully one half of the sewage of the city of Hartford is received into the sluggish stream, the Gully-brook sewer, the largest and most vile sewer in the city, entering but just above it.

The London Lancet, in a recent article, warns European travellers against Canadian and American hotels because of defective drainage and bad plumbing, and yet finds plenty of cause to grumble at similar defects at home. As a sample merely, it gives an account of a fine London mansion, the town-house of a member of the house of lords, wherein it was found on inspection that the basement was honeycombed with cesspools. A number of large brick drains ran in all directions, divided here and there, as a protection against sewer gas, by dip-stone traps. These traps gradually became blocked with sewage matter. The flow thus checked, the numerous brick drains, some two feet in diameter, also became choked up, and were found full to the top with black soil that threw up gases on being touched with a spade. Several cart-loads of this foul accumulation had to be removed. The largest drain went direct into the sewer without a trap, and brought back the sewer gas to the servant's hall by an aperture under the floor where a sink-pipe was improperly fitted into the drains. A branch drain under the kitchen floor was leaking. The fall of the drain passing under the kitchen sink inclined in the wrong direction, so that the entire drains had to be filled before liquid could get away into the sewer.

Dr. G. Arthur Cardew, the officer of health of the Cheltenham, Eng.,

military training college, traced recently an epidemic of sore throat, which ran through that institution in the spring of 1882, to bad drainage. The first case was followed by thirty-four more, some very severe. The large number of cases directed Dr. Cardew's attention to the sanitary condition of the buildings as the cause of the epidemic, and with the architect he made an inspection. The drains were in good condition, but the soil-pipes were old, much corroded and pinholed, and without ventilation. A cistern overflowed directly into one of the soil-pipes, without even a trap. The pipes from the lavatories were in direct communication with the drains, and were half filled with black, muddy deposit. The ventilation of the building was defective, and the dormitories and class-rooms were very foul.

The New York Sanitary Engineer, which has initiated a house-to-house inspection in the dirtiest and most crowded tenement districts of New York, calls attention to 35 and 56 Mulberry street, 72 Greenwich street, 3, 5, and 7 Bayard street, 62, 66, and 68 Division street, and 51 Mulberry street. Of 72 Greenwich street, which it offers as an example of the rest of many thousand such places in New York, one of the filthiest cities in the world, the *Sanitary Engineer* says,—

The building is a four-story double tenement house, 37 feet, or thereabout, front, by 50 deep, the first story covering the whole lot by extensions. In the basement are the privies, as shown, composed of three seats over a school sink. Adjacent to these are the woodsheds, which are too filthy to use for their legitimate purposes, and are made privies of by the multitudes which use the premises. To the right of this, in the same cellar or basement, is a room used as an intelligence office for the lower class of emigrants. No light or air can enter this cellar except by the doors, and two small windows under the area grating, which are obstructed. Immediately over the privies (on the street floor) is a butcher shop. The apparent condition of the shop itself is good, but its juxtaposition to that part of the cellar used as a common privy by about two hundred persons in a day, reeking with human filth, and filled with myriads of little flies, may throw some doubts on the desirability of the location for a dispenser of food for human beings. Next to the butcher is a clothing store, the rear of which is used for a dwelling, and which is partly over the cellar in which the privies are located. Then comes a "bier saloon," in the rear of which the family lives. On the second floor is a German lodging-house for emigrants. In it there are twenty-two beds, with an acknowledged twenty-five adults and three children. Above this are two floors, let principally to Irish families, there being four families to a floor. It is said the lodgers on the second floor use the sink in the hall as a urinal. The women and children on the two top floors are forced to use vessels, and discharge the contents at night in the vicinity of the privies under the butcher shop. The condition of the privies and their surroundings shown—which are the only ones for the building, and which are resorted to by the habitués of the saloon and intelligence office, and by as many from the street as wish to use them—is past cleaning. Layer after layer of sawdust has been thrown upon the places most exposed to view, but it only serves to increase the filth and deceive the unwary. To escape this state of affairs, the woodsheds and passage beyond are resorted to by some, more particularly as urinals, until the earth has become saturated and impervious to the passage of water, so much so that the ground is covered at places an inch deep.

Mr. William Ham. Hall, state engineer of California, reports to the trustees of the Stockton Insane Asylum the very unsanitary condition of that building, as follows:

With several thousand feet of large wooden box drain, which must by this time be filled with decomposing and most foul matter, leading from the buildings through the grounds to the cesspool; with a great pit or hole in the ground, unlined, uncovered, which has for years been the receptacle for all this matter, for a cesspool, the earth of its sides and bottom soaked and reeking with corrupted matter; with an open bucket pump to raise the filthy liquid, all exposed to the sun and air, dripping and dirty the year round; with open wooden flumes, soaked with the fermenting matter of months ago, laid about the grounds for the distribution of the sewage in irrigation,—with these arrangements, I say, you have quite sufficient cause for emanations of the most repulsive kind and far-reaching power, without attributing any part of such noticed effects to the sewage-irrigated grounds themselves. If these grounds contribute in any material degree to this nuisance, it is for reasons of insufficient preparation of them for irrigation, and unsuitable arrangements for the distribution of the waters in irrigation, to wit,—

1. Because they are not under-drained, and consequently (*a*) do not take the sewage water promptly, as they should; (*b*) at times become over-saturated, and give off their superfluous moisture by evaporation from the surface, instead of by under-drainage, as they should; (*c*) do not become promptly aerified after each irrigation, and (*d*) swell upon being soaked, and crack open on becoming dry. 2. Because in distribution the sewage is run long distances in shallow, open ditches, thus permitting the soil enclosing these channel-ways to become overcharged with the liquid, and the bottom and sides of the ditches to become coated with sewage sediment, so that when the irrigation is stopped, and water withdrawn from any such ditch, there is a film or deposit of matter left in it not taken into the soil and deodorized as it should be by it. And finally, 3. Because the irrigation is not carried on with despatch and promptness, but the waters are left running for hours, slowly finding their way about the grounds. This is more the outcome of inefficient distributing works, perhaps, than of poor management in their use.

A staff correspondent of the *Sanitary Engineer* reports the condition of a school-house in Hoboken as a disgrace and a crime, but a mere "pimple on a diseased body." He says that besides having a water-closet that is nothing but a huge latrine between the wings of the building, and immediately beneath the windows of several of the class-rooms, it is also situated upon a marsh that receives the contents of two sewers. Adjoining the school-house is a sluice-gate, that intercepts the sewer water and that of the marsh. At high tide this sluice is opened, and allows the refuse in the sewer to be flushed into the marsh. At low tide all this sewage is supposed to flow out with the retiring waters. But, in truth, a part of the inwashed sewage remains in the marsh. The sluice, then, is nothing but a flush-gate that allows the sewer to be flushed alternately in and out of the marsh, as the tide rises and lowers. At a distance of four blocks behind the school-house another sewer empties into the marsh. It is termed the "Ravine Road." Some time ago it was broken at a point close to the marsh, and its contents were allowed to flow into it. In summer it is said that the odors in this vicinity are something appalling. The mere sight of the place bears witness to this statement. These facts constitute the evils of the marsh. The water-closet, as stated, is but a huge vault, receiving all the refuse of the school, and is emptied every three days. The water-closets, urinal, and the marsh are not the only causes of complaint, though they indirectly contribute to the other evils. To keep the exterior stenches from penetrating within the building, the windows and doors are sedulously closed, and the inmates seem insensible to the vile atmosphere which accumulates in the class-rooms.

The results are indicated by the fact, as we are informed, that many of the scholars are constantly ill, and, on an average, three out of twenty teachers are on the sick-list.

Dr. Lindsley, health officer of New Haven, Conn., recently visited the tenements of that city of 65,000 people, who, for refinement and cultivation, are counted among the best, and he reports one tenement with cesspools and privy-vaults having no connection with the sewers, the decaying material of the building being saturated with the accumulated filth of many generations. He says that the day he made the inspection, "in company with Mr. Mix, was warm; the windows and doors were open, but the air of heaven, however freely it might enter, failed to relieve the nauseating, putrid stenches, reeking on all sides from walls and floors, from stinking rags and beds, and nasty crockery, and the still nastier persons of the inmates. Seemingly, the residents of these hovels appreciate the use of water as a means of making dirt stick to them and about them, and never appear to have thought of it as a means of removing dirt. If this class of Italians were allowed the unrestricted use of the city hall, or the new Welch school-house, their beastly habits would in three months convert those buildings into like unwholesome and pestiferous human pens." Of another nest of houses, "not yet suffering so much from the infirmities of age," he says,—"They are in advanced stages of premature decay, and, with their present mode of use and abuse, will soon be in ruins. Overcrowding and uncleanliness in and about the houses are the chief unsanitary conditions. The privy accommodations are very unsatisfactory, and altogether inadequate for the number of users. The yard about the house is scarcely recovered from a swamp by partial filling, and by abusive uses is little better than a broad, open, drying cesspool. The well, which is in constant use, is a surface well, receiving in a large part its supply from the drainage of this filthy area about it."

In 1882, Dr. Richardson, physician in charge of the Blockley Almshouse, Philadelphia, reported that the sewage from nearly one hundred persons was dumped into the cellar from which the air supply was drawn. The result was the escape of sewer gas by the ventilators, giving a typhoid character to all diseases.

Complaint is made through the Buffalo *Courier's* correspondent of the condition of some of the school-buildings of Cleveland, which are described as being as bad as those of New York, Hoboken, and Philadelphia, and perfect death-traps for the children, whose powers of resistance to the influences of poisened air are, of course, weak at the best, and reduced every day they are so exposed, until disease sets in and death relieves them of their suffering.

The Sanitary Engineer, of New York, suggests that the state authorities of New Jersey might just as well permit the discharge of the sewage of Trenton into the gutters of that town, as to permit the State Lunatic Asylum to discharge its sewage into the Delaware river a short distance above the in-take of the Trenton water-works. The purification and disinfection of this sewage is suggested as the only possible remedy, but this method is delared to be unwise.

Dr. William F. Sheehan, health officer of Rochester, N. Y., in a paper read before the Academy of Science,[1] stated that in a house on Ford street, diphtheria and other diseases prevailed, and the neighbor's privy-vault was found situated close to the cellar walls, and the contents oozing out. In a house on Lake avenue, Rochester, the drain layer had miscalculated the grade, and when he reached the cellar wall, carried the drain in at a graceful bend. Very soon the drainage was obstructed and the cellar flooded. The owner had the pipes dug up, and found not only the above defective grade, but also that the joints had merely been cemented on the upper surfaces, and that sandy soil freely entered at the lower surfaces. In another house on the same avenue, the drain-pipe was found running up hill under the cellar floor. In a public school, recently examined, unjointed agricultural tiles were found in the cellar bottom, designed to carry the waste from fixtures in the school-rooms to the street sewer. The sewer gas became so strong and abundant in the rooms that the children had to be dismissed, when investigation uncovered the above defect. In a private house, from which the doctor had never been absent, a similar drain was found under the cellar floor, and the additional defect of a rat-hole in the bend of the lead soil-pipe as it entered the drain, through which the waste had escaped into the ground, and eventually into a well. The doctor concludes his very interesting paper by the assertion that bad system, poor material, and scamped work have prejudiced the people against all plumbing, until they are ready to cry "Away with it! Let us return to the primitive methods of waste disposal and storage." Men high in authority have lent their voice to the swelling prejudice, and pictured a "struggle for life against civilization and æstheticism" (as represented in particular by modern plumbing and sanitary fixtures). If the words "filth and ignorance," as represented by the popular knowledge of house sanitation, were substituted, I am convinced a more accurate knowledge of the true difficulty of the situation would prevail.

The Philadelphia *Medical News* agrees with Dr. Sheehan, and states that one of the chief causes of the foul condition of the sewers of that city is the discharge into them "of decomposing excreta and other organic matter. If house sewage escaped in a fresh state, and sewers were properly constructed so as to insure the ready and quick removal of this matter before decomposition sets in, the evils most complained of would be averted. With regard to the plumbing arrangements of houses, there is nothing specially to report which is not common to almost all American cities. The best and the worst and all intermediate grades of work exist, as might be expected when the matter is left in the hands of the owners of the property and mechanics. Owners, as a rule, have not the special sanitary knowledge required in designing and supervising the work; the mechanics can hardly be expected to execute the most skilful labor when their financial success depends so largely on the greatest economy in

[1] *The Sanitarian*, vol. xii, p. 319.

construction. Their lack of knowledge of the correct sanitary principles of house drainage is also a very frequent cause of defective work."

These are dreadful pictures in view of the labors of this and state and other similar associations, and of stringent state and municipal laws. They are disheartening in the extreme, but they are, it must have been noticed by my hearers, the result of ignorance and indifference, and of vain attempts to avoid the legitimate consequences of the storage of excretal matter, or the partial removal of it by defective sewers. They prove that as sewage, as poudrette, or in any of its diluted or chemically treated forms, excreta is dangerous to health and life. Fire is the only means of utterly destroying it, and solving the question of its final disposal beyond any power for harm. Let us now consider the question of sewage disposal, at present the one paramount consideration with sanitarians and sanitary bodies.

A correspondent of the *Medical Record*, noticing the still prevalence of typhoid fever in London and Paris, in spite of the progress made in sanitary matters, and the improved systems of drainage, concludes very sensibly that much remains to be done, especially in the matter of house-drainage, before anything like exemption from these diseases in epidemic form is reached. The sewage of nearly all London is emptied into the Thames, between Woolwich and Greenwich, and the river is thus befouled by the excreta of four million people. But all parts of the Thames are polluted by unoxidized sewage. Even above Teddington, some distance above the in-take of the London water companies, such pollution is to be found. The river Wey, a tributary of the Thames, has also been polluted by the sewage of Guildford, and the fish have perished by the ton. But the people along the tidal portion of the Thames, according to the London *Lancet*, suffer most from the nuisance. When the tide turns, a large portion of the sewage is carried up far past the outfall, and is washed about for an unknown time and through an unknown area of the river. Solid human excreta is seen in abundance near the outfalls, and so imperfect is the filtration that baskets have actually been known to pass into the river. In the water the sewage matters putrefy. In the summer the stench of putrescent sewage can sometimes be observed on the river, and still more frequently in the mud on the banks. In winter putrefaction is slower, and the stench is not observed.

A Royal Commission, appointed in 1882 to examine this question, while praising the drainage work that has been done, admitted that the sewage of the great city is having a serious effect on the purity of the lower Thames and its tidal banks. 1. The sewage from the northern outfall is discharged partly over the fore-shore, and not, as was originally intended, through submerged pipes terminating below low-water mark, this arrangement increasing the risk of nuisance from the discharge. 2. The discharge of the sewage in its crude state during the whole year, without any attempt to render it less offensive by separating the solids, or otherwise, is at variance with the original intention, and with the understanding in parliament when the act of 1858 was passed. 3. The

discharge from the main outfalls becomes very widely distributed by the motions of the water, both up and down the river, being traced, in dry seasons, through the metropolis, and almost as high as Teddington; and it oscillates for a long period before finally getting out to sea. 4. In dry seasons the dilution of the sewage is scanty and ineffective, especially at neap tides. 5. It does not appear that hitherto the sewage discharged has had any seriously prejudicial effect on the general healthiness of the neighboring districts; but there is evidence of certain evil effects of a minor kind on the health of persons employed on the river, and there may reasonably be anxiety on the subject for the future. 6. In hot and dry weather there is serious nuisance and inconvenience, extending to a considerable distance both below and above the outfalls, from the foul state of the water consequent on the sewer discharge. The smell is very offensive, and the water is at times unusable. 7. Foul mud, partly composed of sewage matter, accumulates at Frith and elsewhere, and adheres to nets, anchors, and other objects dropped into it. 8. Land dredged near the outfalls, which used to be obtained in a pure state, is now found to be so much contaminated with sewage matter as to be unusable, compelling the dredgers to go farther away. 9. For these reasons the river is not, at times, in the state in which such an important highway to a great capital, carrying so large a traffic, ought to be. 10. In consequence of the sewerage discharges, fish have disappeared from the Thames for a distance of some fifteen miles below the outfalls, and for a considerable distance above them. 11. There is some evidence that wells in the neighborhood of the Thames are affected by the water in the river, and, although there is no proof of actual injury due to the sewage, anxiety may be felt on that account. 12. There is no evidence of any evil results to the navigation of the river by deposits from the sewerage discharge; but this discharge adds largely to the quantity of detritus in the river, and so must increase the tendency to deposit. 13. The evils and dangers are likely to increase with the increase of population in the districts drained. The Committee could not suggest a remedy for this defect other than carrying the sewage farther down the Thames. "The engineers, Mansergh and Melliss, called into consultation with the joint board of the Lower Thames Valley District, proposed chemical precipitation at Mortlake, Hampose, or Barnes as a remedy; but land-owners object, and a double drainage system would be required, separating the storm-water from the sewage. The quantity to be dealt with—446 tons per minute—is the great obstacle; and, as finally reported, the whole question is at a deadlock again, with no feasible way out of the scrape." Messrs. Mansergh and Melliss explain their agents to be salts of aluminum, iron, and lime, which will be delivered fresh, when the sewage will be at once treated, so that in a few hours it can be turned into the river in a clear and harmless condition, the sludge remaining to be transmitted through closed pipes to filter presses worked by compressed air, and thus be made a merchantable manure, easily handled and available for market gardeners. But "Safety-Valve," in the New York *Sanitary Engineer*,

says that "notwithstanding the judicial decision in the Hertford case, admitting that an affluent could be obtained by this process fit, at any rate, to discharge into a stream *not used as a source of water supply*, it would be well to go slow." The question in the case referred to by "Safety-Valve" was raised by the River Lea Conservancy Board against the local authorities at Hertford, who objected that the process was not properly carried out, that the river was befouled, and deposits of sewage matter were found in the stream, and that the brook through which the sewage flowed was a nuisance. The question of the best practical method was not raised, though the judge decided in favor of the local authorities on that ground, ignoring the facts as to the nuisance altogether. He said, in effect, that the local authorities were doing the best they could, even though that best created a nuisance, and were not therefore amenable.

The outflow systems of Torquay and Brighton have been condemned as failures, and the courts have enjoined the corporations of the following cities and towns from draining their sewage into rivers: Birmingham, Bradford, Blackburn, Balton le Moor, Bradbury, Coventry, Chorley, Doncaster, Warwick, Wells, Rugby, Harrowgate, Merthyr-Tydvil, Kendal, Trowbridge, Leamington, Leeds, Halifax, and Moor.

Mr. A. W. Bennett, lecturer on chemistry to St. Thomas's Hospital, London, Eng., has recently made some investigations into the nature of vegetable organisms which are to be found in the effluent waters from sewage purifying works. One he found is a well known sewage fungus, which has globular refrangent particles which have been determined to be pure sulphur.

Mr. Cross, in a paper read before the New Jersey Sanitary Association in December, 1883, says the effluent must be purified after the precipitating process takes place, or there will be a nuisance, and he declares the sludge to be of little value as a manure, and therefore that the process must be considered from an effective sanitary standpoint, and not from a commercial view, as at present is the case, much to the prevention of approximate perfect sanitary results.

But the New York *Sanitary Engineer* objects to this system for large cities on account of the cost. Answering the strictures of the *American Architect and Building News* upon the new works completed by Boston at a cost of $4,000,000, to carry the sewage of that city to within three miles of the ocean, it says that, admitting the supposed value of the annual outflow of sewage from Boston ($800,000), it would cost from $1,500,000 to $2,000,000 in interest and current expenditure to accomplish the result.

The fact is well known, that out of all the sewage farms yet tried in Europe, none, except those on an insignificant scale, have been an economic success, where sewage and rain-water are combined, and where they have been obliged to take *all* the *sewage* from the population throughout the year.

Messrs. Benezette Williams and John A. Cole, of Chicago, in their

report on additional sewerage for Hyde Park, the most populous suburb of that city, declare "chemical and mechanical precipitation processes and the discharge into bodies of water to be unwise."

Mr. Melliss, before the local board of Hendon, Eng., who has had a great deal of experience in this matter of sewage treatment, and for twenty-five years had given it close study, and for the last ten had been exclusively connected with it as a business, who knows all the systems, and had carried out many experiments of his own, recommends the processes of the Rivers Purification Company, because it uses lime or alumina as a base, as may be thought best, and they filter through land or artificial filters. But this Mr. Melliss admits, that *it requires a great deal of care, and that if that is not had it becomes very dangerous;* and the manufacture of manure from water-carried sewage had ruined several companies, and a total of $500,000 had been lost by them.

At a meeting of German sanitarians, held in Berlin in May last, Professor Rudolph Virchow, who was the prime mover in the existing sewer system of Berlin, condemned all systems of sewage farming for any length of time, because the air became seriously affected thereby and serious danger to the public health ensued, and attributed the greater violence of epidemic diseases in the country districts, as compared with cities, to the privy system and defective drainage. As to the introduction of fæcal matter into water-courses, he considered it in all cases of doubtful advisability, and only permissible when the current is of a suitable character, and even in such cases some arrangement for disinfection and the formation of sediment is necessary. He went even further than this, and recommended official control of the pouring into rivers of street and domestic waters, as in warm weather fermentation takes place, seriously endangering the public health. He expressed his opinion that open water-courses in cities of one hundred thousand inhabitants and upwards should be free from the introduction of such matter as had been referred to, and reminded his hearers that it was a mistake to suppose that fast-flowing streams carry everything away. He then alluded to the utilization of sewage for agricultural purposes, and remarked that Berlin had, in this respect, made greater progress than had been the case elsewhere, although the arrangements were still, to a certain extent, of an experimental character. He disagreed with Dr. Emmerich, and did not admit the force of that gentleman's theory that the movement of water destroyed the living organisms in drainage liquid; experiments made by the government resulted in establishing the fact that within one cubic centimetre of water (.061 cubic inch) taken above Berlin from the Spree, 10,000 germs, capable of development, were found. At the city itself the number was 950,000; below Berlin, 4,800,000; and at Charlottenburg, four miles from Berlin, as many as 10,180,000.

An English royal commission, reporting on the pollution of the Mersey, as long ago as 1870, stated that "sewage discharged in running water is not materially changed for many hours by oxidation, and that there was not a river in England long enough to dispose of a moderate

amount of sewage through oxidation. For this reason the Prussian government has forbidden the pollution of rivers and seaports by the discharge of sewage." A later commission, composed of Messrs. Dennison, Frankland, and Morton, reported: "The actual resources of chemistry do not permit the hope that the polluting matter dissolved in sewage can be precipitated and sent away by any appliance of chemical reaction, and unless new chemical laws are discovered, it is useless to attempt the employment of chemical agents. Epuration must be confided to Dame Nature."

From this mass of scientific and official testimony, covering practical experience in many places and the observation of many years, it must be admitted that all the existing methods for the disposal of sewage are failures, and failures because, as I have said at the beginning of this paper, they are systems for the removal and not for the destruction of it. It must be destroyed. If there is any one thing sanitarians are agreed upon, it is that human excreta is the most potent factor in the transmission and perpetuity of diseases. Thirty years ago, Pettenkofer, and more recently Koch, proved by unquestioned tests that the cholera germs are contained in the excrement of the diseased; that in consequence it is transmissible from place to place without personal contact, and that consequently localities may be the means of spreading the contagion. This theory suggests, itself, the means of preventing the disease, and the fallacy of quarantine as a preventive of transmission. The prevalence of epidemic cholera in three of the principal cities on the European coast of the Mediterranean sea strengthens this suggestion, and emphasizes the necessity for increased vigilance and constant and complete sanitary work. The people must be saved from their habitual tendency to reckless indifference where health and life are concerned. They must by law be taught better. The governments of Europe are becoming alive to this, and to the necessity for the enforcement of sanitary laws and for efficient sanitary work, as the great means to that end. They can no more, from an economical point of view, withstand the losses of life and consequent loss of productive capital entailed by these epidemics, than the manufacturer can the loss of the money capital that is the foundation of his power and the source of the results of his labor and his machinery. The filth of Toulon, the harbor of which is a cesspool, cannot be permitted to stand between its people and the commerce that is as the breath of life to them. Marseilles cannot afford to have her ports closed to the shipping of the world at an expense of hundreds of millions of dollars every ten or twenty years. She must find some other means of disposing of her sewage than emptying it into a harbor that is as filthy as that of Havana, whose waters cannot and are not used by the seamen of the world, so strongly tainted are they by excreta. Naples, the largest and most important port in Italy, the restored and civilized Italy of Cavour, can better afford to tear down and dig away to their foundations the pest-breeding nests of her lazzaroni, and build homes for them upon modern principles of hygiene, than suffer the recurrence of the decimating process that

alarmed all Europe the past few months, and aroused the sympathies of the world even for a besottedly ignorant population, a population degraded in body and mind by long centuries of a brutalizing system of government that ended with the death of a king literally the prey of lice, the direct product of his own physical degeneracy and filthy animal existence. Italy and France, if they would keep pace with the rapidly moving modern world, must turn their attention to the ways and means that conserve life; for life can only be conserved by cleanliness, and cleanliness can only be enjoyed as the result of constant cleaning up, under unremitting and searching sanitary supervision. Labor is the modern power. It lifts nations into prominence, and according to its statistical evidences of growth are they graded. Nations are now rated by the value of their products and commerce, and not by their standing armies. Good health is essential to the increase and conservation of this power, and cleanliness is absolutely essential to good health. England, first in sanitary science above all the nations, has made all her conquests, and stands first among the empires of ancient and modern times, because her home territory is a busy hive to which the whole world goes as purchaser. Since 1831, while the nations of continental Europe were wasting their lives, and therefore their best substance, in internecine tumults, revolutions, and inter-state wars, England was advancing in all the arts of peace under the direction of prudent ministers, guided by that fine common-sense that is the best product of the Anglo-Saxon mind. She was advancing all along the line of individual well-being, and through her laborers—her patient, plodding workers—was subjecting the world to her will. To her belongs the first formulation of sanitation as a distinct science, and to her belong some of the best results of that science. From that day in 1856 when Florence Nightingale began the sanitary work that extended like a heaven-sent beneficence from the hospitals of Scutari to the furthest ends of the world, sanitation has continued to help and benefit mankind, to increase the self-respect of individuals, of nations, and of communities, and lead them away from false conceptions of the duties of governments in their manipulation for the benefit of the few, to the real and the right one, "the greatest good of the greatest number." England, like America, is alive to the value of individual as well as communal hygiene, and she maintains large bodies of professional sanitarians, who are every day devising and suggesting new methods for the disposal of house and street wastes, the one most vexing problem of the age. To her, then, we must look, next after our own country, not only for encouragement, but for the tendency in new inventions and new methods of work that point to the ultimate of sanitation. Searching her records as we search our own, we have found that what has been accomplished of sanitary work is but as a drop to the vast amount that yet remains to be done. We have found that her cities, towns, and villages are yet largely cursed by the privy system; by defective sewers, defective plumbing, and inadequate means for the disposal of sewage and of house and street wastes; that her rivers, the sources of her water-supply,

are still being polluted by sewage, and her harbors are being filled up with it; and that, although she expends vast sums, has accomplished a great deal, and reduced her death-rate, the majority of her people are suffering from the consequences of their own ignorance, and are daily storing the one most dreadful and certain of all the means we know of for the perpetuity and transmission of preventable diseases. To excreta and decaying organic matter poisoning the air, the water, and the soil, they largely owe the presence of diphtheria, typhoid fever, diarrhœal diseases, some forms of lung, throat, and skin diseases, and to kitchen slops, cesspools, and privy-vaults the pollution of the wells, springs, and streams that are the sources of water-supply for large populations. Parkes says, in the opening sentence of his "Manual of Practical Hygiene," that "the supply of wholesome water in sufficient quantity is a fundamental sanitary necessity."[1] Owing to density of population, and consequent soil saturation, this is in many places impossible. If the soil of a city is saturated with sewage, or the gases from sewage, or by coal gas, as is often the case, the wells and cisterns, or the houses, cannot escape contamination. Nor in agricultural regions, where animal and vegetable wastes are constantly finding their way to the streams that are the cities' largest sources of supply, can they be pure; nor in cities with unswept streets can cisterns be exempt from the operations of animal waste, which in the form of a fine powder is carried by the winds to the roofs of the houses, and is thence washed into them. It should be the especial work of the sanitarian to reduce to a minimum the causes of the pollution of water. Sewage should not be drained into water-courses, no matter what the chances of purification, within supposed or asserted well ascertained distances. Nothing should be left to chance. With the experience of so many sanitarians, of so many patient, plodding chemists, so many closely investigating microscopists, we should approximate certainty in every instance, and advise and urge the public authorities, in cities, towns, and country, to suppress all forms of nuisance, and to adopt as rapidly as possible the best means, by cleanliness, personal and general, of promoting the public health. To accomplish this, the water for general use must be pure, and free from all contaminating gases, from decomposing excreta, and vegetable and animal matter. This will necessitate the abolition of all privies and underground drains, or vaults or sewers, and the enactment of a law with stringent penal clauses forbidding the storage of excretal matter in vaults or pits, or its attempted assimilation in sewers, where decomposition has plenty of time for its deadly work, owing to want of flushing, and compelling this and all

[1]A European correspondent of the New York *Times* telegraphs that paper on the 5th of October, 1884, that "the mastery of the plague in Genoa is really the first fine medical feature of the whole siege. Immediately after the pest broke out with virulence in that city, a fortnight ago, the authorities had the water-supply analyzed, and they discovered that of the three sources of supply, that of the Nicolai company was awful. The Municipal works supply was pretty bad, and that of the Gerzenti company was pure. Immense and costly efforts were promptly made to shut off the first two sources, and to turn the latter water into all pipes. An immediate improvement was noticed, and the mortality declined after eight days, instead of advancing for weeks, as has usually been the case."

forms of house and street wastes to be subjected to the ordeal of fire, the only purifier. This is the ultimate of sanitation.

That way lies the pressure of sanitary experience; that way lies perfect sanitation, as perfect as human beings can accomplish, and in no other way can it be even approximated. Everything else has been tried, and failure has resulted. A brief recital of the genesis of sanitation will prove this. From the brutalizing habits of the Middle Ages, when the excreta of towns and cities was dumped into the unpaved streets, there to fester and decompose, an ever-increasing sea of pollution and death, it was but a step to the privy, the storehouse where death has found for centuries a constantly reinforced arsenal of disease to do his work of decimation, polluting earth, air, and stream. The bucket system—still in vogue in South America, in China, and in some European cities—was an improvement on this only so far as that the excreta was taken from under the noses of the citizens. Sewers were but one step further as a mechanical means of removal—simple and available where water was to be had, but deadly and dangerous because of the gas evolved from decomposing excreta, and its steady pollution of the rivers and bays into which it flowed. An improvement on this is the disposal of sewage on farms by precipitation, or by the intermittent downward filtration system, or its manufacture into poudret, or by the pneumatic system of Liernur. By these latter systems river and harbor pollution is avoided, but the manufacture of sewer gas goes on, and soil saturation is still a result. Partial or utter failure by these processes points plainly to the use of fire as the only means of utterly destroying the most potent factor in the dissemination of disease, of killing the germs that find in animal excreta their nidus—their means of life and perpetuity. And until they are utterly destroyed sanitarians will still find work to do, preventive medicine will still be a study, and preventive diseases still continue to lead all others in the work of death and decimation among the most industrial populations, thus occasioning losses to the state greater than all others, by fire, flood, or tornado combined. When a physician undertakes the work of cure he does not ignore the final means;—he is not content to partially cure his patient; he does not discharge him until he leaves him free from the disease of which he had been the victim. The sanitarian, like the physician, must leave his patient well; he must leave the city, the town, the village well, free from all possible pollution of earth, air, and water, free from all transmissible germs by either of these elements. To attain to this, the privy, the cesspool, the midden, the sewer, the graveyard and cemetery, must be abolished. The crematory must take their place. Within two centuries the death-rate of London has been reduced by successive steps in sanitation, from excreta-reeking streets to sewers, from 42 to 22 per 1,000. This is a great result, great not only in the saving of life, but in the moral effect it has upon a vast population. Yet even this can be improved upon, and will be, as the constant efforts at sewer improvement and for the final disposal of sewage by the Board of Public Works certify. It has been claimed that modern sanitary work has

resulted in an average decrease of the death-rate by thirteen per cent. This, with only partial and admittedly defective work; with complete work, as absolute as nature will permit, what would it be? We must go back to the laws of Moses for an answer and for encouragement. While other and neighboring nations were decimated by disease, the Jews in Palestine were almost entirely exempt, so long as they obeyed the sanitary code of the greatest of all national leaders and law-givers. Reading that code, the ultimate of which was by fire, we find that Moses condescended to a minutia of personal as well as national sanitation that no other people have ever profited by, even since the spread of the gospel. And the result is seen to-day in the transmission to the Jews of our own time of physical powers of endurance and a mental strength and activity, that, taken man for man, cannot be matched by any other people. To fire we must have recourse. What the Jews have done in a crude age, we must do in a better and more enlightened.

Fire is the only thoroughly cleansing element. It is the great purifier. The fire of London, following after the plague, prevented its recurrence, and was one of the greatest blessings to that then pestilence-breeding and plague-ridden city. This is now so well understood that the question of cremating the dead is everywhere receiving attention. The commissioners of charity and correction of Brooklyn, N. Y., have under advisement the cremation of the pauper dead as an economical as well as a sanitary measure. They say that whereas it costs an average of $6 to bury each pauper, by a proposed plan of cremation it would only cost $1.50. In London a committee of scientists, as far back as 1849, pointed out the dangers to the populations of cities from the cemeteries, the vicinity of each of which was never free from preventable diseases. For this cremation is the only remedy. The prefect of the Seine has ordered the cremation of all bodies not called for by friends or relatives; and this, it is believed, is but the prelude to the passage of a general law by the French chambers legalizing cremation throughout the republic. In Lower California the yellow fever dead of last summer were cremated, and, it is believed, with good effect. San Francisco has just erected a crematory, with the stimulus of a growing favorable public opinion to encourage the company. Pittsburgh is about to erect, or has erected, a crematory, in which natural gas is to be used; and New Orleans threatens to be the first American city to make cremation of the dead general. Chicago is also establishing a crematory, and in New York a company has been formed with capital sufficient to put up a handsome chapel and crematory, just as the Chicago company has promised to do. The Rev. John D. Beugless, a chaplain in the United States navy, president of this New York company, and a distinguished member of this association, gives as the controlling reasons governing his preference for cremation over the old systems of graveyards and tombs, that experience proves these to be "vast magazines in which are stored every day the germs of all kinds of disease. We speak of the earth as purifying what is put into it in this form, but it only does it by serving as the agent that gradually throws off

the elements composing it. They are thrown out to the surface. It has been found by actual experiment that in the spring of the year, when the ground is wet, and in a season of calm, the atmosphere over a densely buried cemetery is so fatal that a small portion of it injected under the skin of a pigeon, for instance, will produce all the symptoms of typhus fever, and the bird will die of it in a few hours. The region lying about these densely buried cemeteries, and especially to the leeward of them, is always so affected by these escaping products of the decomposition that the residents of the neighborhood are constantly suffering from diarrhœa, headache, sore throat, and other symptoms approaching the diphtheric in their character, and often diphtheria is very virulent in those regions. A year ago last spring, for instance, there was a marked increase in typhoid fever in the neighborhood of Trinity cemetery, in New York, while in no other part of the city was it particularly prevalent. Brooklyn is environed with cemeteries on all sides except the water front. There are about three thousand acres devoted to that purpose on the outskirts of Brooklyn. The prevailing winds in summer are from the south and south-west, which carry these disease germs as they escape right over the two cities. Flatbush has a death rate more than double that of Brooklyn." The same reasons thus given so forcibly for the cremation of the dead will apply with a thousandfold greater force to the cremation of excreta and household and street wastes, because there is more of that sort of material. The world is slow to adopt reforms. They are innovations, and are therefore never welcome. First, there were caves for the dead, then churchyards and vaults, then cemeteries, to be followed by crematories. The dead must not be permitted to make life a burden to the living.

The next step in the line of progress is cremation, and it has already been taken by thousands of householders in all the states, who cremate all of their household wastes and kitchen garbage, greatly to their comfort and relief. The kitchen stove is found to be a convenient furnace, and into this everything but excreta is dumped to be utterly consumed, and thus put beyond the process of fermentation and slow decay, which make the ash barrels in many cities a nuisance at almost every door. But a longer step toward the ultimate, and a more important one, is the crematory established in 1883, in London, by Mr. George Shaw, for the destruction of the refuse and street wastes of that city. This crematory, or destructor, is thus described by the *Sanitary Engineer*, of London :—

As erected at Letts Wharf it represents externally a cubical mass of brickwork about thirty-six feet long by twenty-four feet deep, and twelve feet high. It consists of ten compartments or cells lined with fire-brick, all well tied, and bolted together with strong iron tie-rods with substantial wall-plates at the ends, and wrought-iron channel and angle irons along the front of the furnaces. The top forms a perfectly flat platform, having five openings about three feet by two feet, each in the centre, into which the refuse to be burned is shot or shovelled. About a wagon-load of refuse is sent into the holes or openings referred to, each time the furnaces require feeding; it falls upon a sloping hearth, which is covered in by a reverberatory arch of fire-brick, and it slides forward when sufficiently dry toward the fire-bars, where it burns somewhat fiercely, the fire-brick arch

above concentrating the radiant heat upon it. The opening for the entry of refuse is divided from the opening for the exit of gases by a wall, a bridge preventing the refuse, which is heaped up immediately below, from finding its way into the main flue. Two cells are provided with special openings about three feet by three feet, immediately over the red fires, for the introduction of infected mattresses or other bulky things, where they are readily consumed without causing a smell. In several towns these openings have been found valuable for destroying condemned meats. At Leeds, during the year ending December, 1883, they consumed 14 carcasses of beef, 15 carcasses of sheep, 160 carcasses of pigs, 8 carcasses of calves, 3 carcasses of goats, 2 carcasses of horses, 1 carcass of donkey, 130 rabbits, 156 dogs, 48 cats, 220 beast heads, 6½ tons of shellfish and shells, besides 33,000 loads of ordinary refuse. The commissioners, however, have another effectual method of treating their condemned meat, though they may find the openings useful for animals that have died of infectious diseases. The gases from the furnaces on their way to the chimney-shaft pass through a large multitubular boiler of special construction, and arranged with flues so that every particle of heat may be utilized. At intervals, varying according to the refuse that is burned, the clinkers, which are simply a fused mass of glass, earthenware, etc., are withdrawn through the furnace doors, and a further charge of refuse shovelled in at the top. The result of the process is, that everything is consumed, or converted either into clinkers or a fine ash. The destructor is estimated to deal with sixty loads in twenty-four hours; but from results already obtained it is expected to exceed this amount when the workmen become better acquainted with their duties. The labor of two men suffices to feed the cells by day, and that of two by night, and a similar number for the withdrawal of the clinkers, etc. As before stated, the hot gases pass through a large multitubular boiler, where they generate steam to drive a horizontal engine with 18-inch cylinder and 3-feet stroke. This engine works three mortar mills with pans eight feet in diameter. Into these the clinkers made in the destructor may be mixed with lime and ground into mortar. From the same boiler steam is also conducted to two four-horse-power engines, fixed at the end of the destructor, which drive powerful gearing automatically arranged to lift the wagons as they enter the yard, and to tip their contents directly on the top of the furnaces. No fuel of any kind is required, the refuse being amply sufficient to generate steam to drive the whole machinery. A small vertical boiler is connected with the small hauling engines in case they are required to lift refuse when starting the works. At the time of the visit there was only one lift in action, but it was evident that the steam power would comfortably lift more than was required if both were in use. We saw the wagons enter the yards from their rounds of collection in the city. They contained almost every conceivable kind of waste. One wagon made a special delivery of several hundred rotten cocoanuts; but cocoanuts, dead dogs and cats, shellfish, with other offal, had all to undergo the warm operation of cremation, and all this apparently disagreeable work was carried on without the slightest nuisance. We watched the wagons drawn under the lift. When in position chains were quickly attached, and in less time than it takes us to write, the wagon body had gone up and was being emptied on the high level platform; while the horse and wheels were standing on the ground level, the wagon body almost immediately reäppeared empty, and was delivered into its position again between the wheels, and then the horse and wagon were started upon another collecting round. This ingenious contrivance which lifted the wagon appeared to be comfortably worked by one man, so situated that the wagon was from first to last always in his view. The gearing is, however, automatically arranged to stop itself in case the man should neglect his duty. The drawing of the clinkers gave us ample evidence of the heat contained in the cells—molten metal and glass, etc., in one red glowing mass, forming in some instances, in bulk, cinders two feet long by one foot wide. Water is conducted near to hand, by which the clinkers are slacked, and taken at once to the grinding or mortar mills. These works, from a sanitary and probably financial point of view, are, beyond doubt, far ahead of similar business works, either in London or elsewhere.

Here we have an excellent beginning toward the ultimate of sanitation. That crematories, or destructors, will be erected in other portions of

London, and as fast as funds can be procured for that purpose, there is no room to doubt. The cremation of street and household wastes is thus placed beyond question. The only thing that remains to be tried is the cremation of excreta. That secured, the whole problem of sanitation will be solved. At least one of the prominent sanitarians of Europe, Mr. John Young, inspector of cleansing, Glasgow, has his mind turned in that direction. In the second of his papers on "The Scavenging of Towns," published in the Chicago *Sanitary News*, he says,—

> The refuse of a town whose excrementitious matter is all disposed of by water carriage cannot be said to be of great intrinsic value. Its practical value, however, as in the case of other goods, is what it will bring. We know that towns which command large tracts of agricultural land may, and in point of fact do, get money out of police manure of a quality inferior to that which other towns, differently situated, are compelled at considerable expense to destroy. In any case, however, there is a furnace to fall back upon. When the supply proves greater than the demand for manurial purposes, the supply can be curtailed by burning the worst of the material; and just as the demand decreases, the burning power must increase.

Summing up all the testimony adduced in this paper, the conclusion is legitimately reached that the cremation of excreta and all household and street wastes would—

1. Preclude the possibility of the return of such wastes in any deleterious form, as is the case now universally.
2. It would save to all cities two thirds their present water supply, and thus increase the quantity for personal sanitation.
3. It would put a stop, beyond all question, to soil saturation and sewer gas.
4. It would reduce scavenging to the minimum of expense, and save much of the cost of hauling, and of great sewerage works like those of Boston and London.
5. It would put a stop to all the nuisances complained of from defective plumbing.
6. It would prevent the silting up of harbors with excretal matter, and their being choked with silt.
7. It would prevent the pollution of rivers, and so prevent the wholesale destruction, as is now the case, of fish, the poor man's free food crop.
8. Equally applicable to hamlets, villages, towns, and cities, it would put a stop to the privy and cesspool system, and thus prevent the saturation of soils, which frequently drain into the water-courses that are the sources of supply for great cities.
9. It would solve all the problems that now vex sanitarians, from house connections to the outflow through which sewage finds its way into rivers and harbors.
10. It makes a finality of all the wastes of cities, of every kind, character, and description, the result being, according to Shaw's method, an ash of great value to farmers, and clinkers that have a special commercial value for builders.

XVII.

CREMATION AS A SAFEGUARD AGAINST EPIDEMICS.

By JOHN D. BEUGLESS,
CHAPLAIN U. S. NAVY.

The late eminent Professor Hecker, preëminent as a medical historian, has left on record, repeated and emphasized, the opinion, which appears to have been with him a profound conviction, that epidemics of contagion are by no means unmitigated calamities. In support of this well-nigh startling proposition, the learned professor was wont to cite three noticeable facts :

1. That, as a rule, the victims of epidemics are taken from the non-producing classes,—the wealthy and voluptuous on the one hand, and the shiftless and impoverished on the other. This he attributes to the impairment caused by drinking habits and associated licentiousness, and to the want, in both these classes, of a vigorous and healthy activity of body and mind, which leaves them without the tone and stamina necessary to meet and successfully resist disease. The taking off of these idlers, whether they be "wine-bibbers and gluttons" or worthless vagabonds, Dr. Hecker more than intimates may not be wholly without advantages to the general public.

2. This eminent sanitarian suggests that the general habits of cleanliness, moderation, and thrift, begotten of these epidemics, and continuing with the people after any specific scourge has passed, go far toward compensating for whatever loss of life and property the visitation may have entailed.

3. Professor Hecker maintains, with much ingenuity and with some show of plausibility, that great epidemics are followed by "epochs of development, wherein the mental energies of mankind are exerted in every direction ;" and to this strange parentage he credits the birth of the genius which in Gutenburg invented the printing-press, the military prowess which in Sobieski hurled back from the gates of Vienna the besieging Moslem hosts, the faith and zeal which in Martin Luther achieved the Reformation, and the intelligent ambition which in Columbus discovered America ;—and it is a curious and noticeable coincidence, that each of these historical events followed closely, in the country of its origin, an epidemic of what is known as "the black death"—an epidemic which devastated Asia and Europe from China to Iceland, and with whose awful ravages none of modern times compares ; a scourge which, within a few brief weeks, numbered its victims by scores of thousands in each of several of the great capitals of Europe.

Notwithstanding all these compensations, real or imaginary, there will probably be found to-day no people of the world who will deliberately, and of choice, extend a hand of welcome to such a ghastly visitor.

"The pestilence that walketh in darkness and the destruction that wasteth at noonday" strike terror to the bravest hearts whenever and wherever they appear; and to "avoid it as we would a pestilence" is proverbially the strongest language we can command in which to express utter loathing and abhorrence.

How then shall we best avoid epidemics of contagion?

Others will discuss their etiology, and discourse upon their means of transit and their doors of ingress. Quarantine regulations, disinfectants, systems of sewerage, and other sanitary regulations of the often-tried and ever-found-wanting character, will each in turn claim our attention, as they have done before, and from them all we will hope and trust for the best; for whatever else may come to our assistance and relief, all these agencies, used and directed with intelligence and zeal, will ever more be necessary for our safety. Despite all these, however, epidemics come,—but, fortunately, thanks to our isolated position and our not yet over-crowded population, less frequently and with less virulence to our own than to most other lands. There is no cordon of soldiery and no quarantine surveillance that can give us certain immunity from yellow fever or the cholera. It comes by the usual and by unusual routes of commerce and of travel. It comes with our choicest tropical fruits, our finest Bokhara rugs, and our loveliest India shawls, as well as with the cargoes of rags from Egypt and Italy. It comes with our returning tourists, our visitors, and our immigrants. It comes, too, as the dust comes to the ship a thousand miles from land. It comes on the wings of the wind; and most literally it "walketh in darkness."

Finding a pestilence approaching, or upon us, what shall we do to protect ourselves against it? Shall we expect or hope to drive it out by arming our quarantine boats with bottles of chlorine, corrosive sublimate, and carbolic acid, and bombarding therewith the dread enemy? Experience has shown that it were almost as well to throw upon it a spray of eau-de-cologne or extract of sweet violets from an atomizer. Moreover, disinfectants are a sort of boomerang, and are perilous in use in direct ratio to their efficiency, as witness sulphurous acid, nitrous acid, and chlorine, each offensive to a degree, and positively injurious to the respiratory organs.

Shall we fumigate? Burn, if you choose, upon the infected ship, the delicious pastille with which the Turkish pasha disinfects his harem, and you will at least have the fragrant perfume for your labor, but waste not your time in fumigating these carriers of disease.

The question repeats itself with emphasis, What, then, shall we do to protect ourselves most thoroughly? Is there no sure way of destroying the destroyer before it has destroyed us?

In endeavoring to frame a satisfactory answer to this question, a layman may, perhaps, without pretending to have investigated the subject

for himself, be permitted to take for granted, as established by modern scientific experiment and research, certain propositions relating to what is called "the germ theory" of the origin and mode of propagation of acute zymotic contagions, whether they be epidemic with us, as cholera, the plague, and yellow fever, or endemic, as small-pox, scarlet fever, and diphtheria. Whatever diversity of view there may be among investigators, as represented by Pasteur on the one side and Bastian on the other, as to whether or not there is a specific microbian organism which produces each particular type of zymotic contagion, they are quite agreed that such disease is always characterized by the presence of such microbia, and that these organisms are preëminently its most efficient carriers. Whether they belong to the etiology of the disease in its incipiency, or are only pathogenical products thereof, their presence and their office as carriers cannot be successfully denied. And if pathogenical products only in their origin, they certainly become etiological in the after-development and spread of the contagion. Furthermore, it seems to be pretty well established that these microbia are specific, and characteristic in many varieties if not in every variety of zymosis.

Each, it would seem, is the carrier only of the particular disease of which it is characteristic, or in connection with which it has its habitat. Hence no one ever takes cholera from yellow fever, or small-pox from measles. The micrococcus diphthereticus never produces erysipelas or septicæmia. Dr. Bastian's archebiosian theory, so strongly supported by Dr. Burdon Sanderson, is not irreconcilable with these widely observed facts, although it would seem to make provision for facts the reverse of these, should such be at any time observed.

Each species of the contagium vivum, so far as observed, has its own native habitat, its own particular range of capacity, and its own properties of resisting or enduring heat, cold, moisture, drouth, and exposure to hostile forces and conditions. Hence the imperfect success or total failure of efforts and experiments intended to destroy them by means of various disinfectants, as also by freezing, drowning, steaming, boiling, burying in the earth, and by dessicating. By some of these agencies a few of the less hardy may be destroyed, and doubtless all of some varieties, while in other cases what proportion is not known; but certainly in the cases of bacteria characteristic of some of the most dreaded forms of pestilence, the best and most efficient of these disinfecting agents and conditions serve only to suspend activity until the microbes find a more favorable environment. In the case of most of them moisture and warmth seem to be the conditions favorable to their greatest development and activity, conditions which, during the summer months, are fulfilled to the last degree in our cesspools and sewers, and in our church-yards and cemeteries, wherein our pernicious practice of earth-burial is storing vast magazines of these microbia, to come forth in the forms of plague and pestilence whenever circumstances shall be found favorable.

The tenacity of life of these bacteria is such, that a burial in the earth for hundreds of years seems but to add to their potency for evil, as wit-

ness the cholera in London in 1854, the virulence of which was greatly aggravated by cutting a viaduct through an old burial-ground, and the plague in Modena in 1828, which resulted from disturbing the ground where victims of the plague had been buried three hundred years before.

In all that has been said, it is assumed that earth-burial has been as thorough and satisfactory as possible; but, in the presence of epidemics, how seldom is this the case! How frequently is it superficially and imperfectly performed, thus offering the disease germs conditions the most favorable for speedy development and propagation, so converting the cemetery into a very hot-bed of contagion!

There is one condition, however, readily producible at almost any point where man has his abode, which no living organism has been found to withstand; and that condition is a temperature of from three hundred to twelve hundred degrees Centigrade, the range of temperature at which cremation is effected by the various apparatuses now in use.

No disease germ, it is safe to say, has ever been known to pass through the crematory fires and survive to propagate its species, or to serve as the carrier of disease. The crematory is the only never-failing germicide.

If we still hold to the old theory that these various forms of zymotic contagion, whether epidemic or endemic, are produced and propagated by chemico-molecular action, then it is equally true that the all-purifying fire is the one only known means by which that chemical action can be effectually and unfailingly arrested, and the poisonous compound reduced to its simple constituents and rendered innocuous.

And if there were no epidemics or contagion coming upon us from without, let it be remembered that more than thirty per cent. of all the deaths reported in our vital statistics are occasioned by acute zymotic contagion, from which the crematory is the only thoroughly reliable safeguard.

Instead, therefore, of putting our beloved dead into a damp, dark hole in the ground, there in the companionship of loathsome bacteria to putrefy, and thence to send forth the poisonous and deadly exhalations and emanations of the grave to seize upon the tenderly ministering survivors and drag them into the loathsome caverns where disease and death hold carnival, let us purify the material of their bodies from every defiling and corrupting agency, and translate them decorously and reverentially, but expeditiously, into the elements of all new and beauteous life.

Nor should we stop with the incineration of our own kindred dead. Let us perform the like gracious office for the bodies of all the victims of disease brought on ship-board into our ports, especially for all victims of ship-fever, yellow fever, small-pox, cholera, and every other form of acute zymotic contagion; and let us consign to the same all-purifying fire whatever of dead matter has become the nidus or carrier of like disease.

Let our municipal authorities establish a crematory at every quarantine station, and in connection with every public hospital, and in every potter's field.

The potter's field of almost every city of the land is a disgrace to civilization and a pest-bed in the community, and many of the more reputable church-yards and cemeteries are little better. Beautiful and park-like as they are without, within they are "full of rottenness and dead men's bones."

Let our county commissioners erect a crematory in connection with every almshouse and penitentiary. Let the state do the same in connection with our state prisons and asylums.

Let the national government make like provisions in connection with the army, navy, and marine hospitals and asylums under its control; and to this end let this influential association memorialize our national, state, and municipal governments.

But we should not stop here. All the garbage of our great cities, with much of the refuse that now goes into the sewers to lodge and fester under the wharves and on the shores of our else fair bays and rivers, aye, the entire sewage of our cities, should be cremated by an approved regenerative process, by means of which all the volatile products of the combustion may be reburned and purified. Thus may our land become indeed, as it should be, "the land of the living," no longer given over to be "the valley of the shadow of death."

XVIII.

THE SQUALID DWELLINGS OF THE POOR—A SOCIAL AND SANITARY REPROACH.

By C. W. CHANCELLOR, M. D., Secretary of the State Board of Health of Maryland.

Careless manipulation in the prosecution of an analysis may adulterate a long and laborious investigation, but the disappointment occasioned by such a failure can only be measured when we know the practical consequences of the genuine result. In studying the laws of dead matter, an ungrounded conclusion will seldom endanger life, or induce sickness; in ascertaining the weights and distances of the heavenly bodies, the discrepancy of a few grains or inches can never be a fatal error.

Mind may be analyzed according to the taste of the metaphysician, and dissected into five or fifty rudimental principles; stars may be weighed by avoirdupois or apothecaries' weight, as it may best suit the fancy of the astronomer; and the world may stand forever marshalled into two or more conflicting sects on any abstract question of theoretic science, without involving in their differences the welfare of a single interest, or the safety of a solitary individual. But in a science having for its objects the prevention of disease and the preservation of health—of all desired objects the most desirable—the simplest theory cannot be indulged in without involving a thousand lives. A random step upon such sacred ground must lead to danger, may lead to death. The lives of our fellow-creatures are the material we experiment upon; their happiness or misery is the issue to which every experiment must tend. A faithless rule or fanciful theory may occasion a wide-spread and woeful pestilence. Reasoning, therefore, in such a science should be conducted on the most rigid principles, and the chaste prose of sober truth should never be adulterated with the meretricious poetry of drunken fancy.

A careful consideration of the dwellings of the poor in crowded cities has led to this admonitory preface. It is an important question, involving the very essence of urban sanitation, and as the points about to occupy attention relate immediately to this question and its bearing upon the public health, we are anxious the public should look with their own eyes into the consequences of the evil, in order that they may see the exceeding hazard which its continuance must occasion.

Were the extent of disputed territory limited to a few inches or a few feet, the value of conquest might be of little importance; but it is a wide and spacious interval which is the subject of contention. The grand point at issue is not a verbal difference, or a conventional technicality; it

is an important practical question. It is whether we shall continue to maintain in our cities and villages the most fruitful source of zymotic fever; a disease which spares no age, nor sex, nor condition; which comes into our families unseen and unprovided for; which creeps from house to house with noiseless progress, and covers entire districts with death and desolation,—it is whether such a monster can be more effectually killed by being starved or by being fed.

If an investigation should be carried on, and a report made upon the insanitary condition of the dwellings of the poor in our large cities, it would reveal a frightful picture of misery and vice, fitted to excite and shock humanity. Public inquiry would show these dwellings to be an infamy to civilization—places where no care can protect their occupants against disease; where sobriety and decency are physical impossibilities; and where men, women, and children are smothered in filth and vice. A writer in an English paper, calling attention to these habitations a short time ago, says that in them "disorder is perpetual, and disease never absent. At times whole streets are blockaded, as it were, against the police, and then a pandemonium of violence proceeds unchecked. Every Saturday and Sunday the inhabitants of these 'rookeries' give themselves up to a drunken orgie, and scarcely a week passes without some shocking crime is perpetrated, thus demonstrating the connection between filth and immorality."

If we turn our eyes to the condition of these dwellings in our own country, and the forlorn condition of those who occupy them, we are at once impressed with a melancholy conviction of how little has yet been done to improve the lot of the great mass of the human race. Modern ages have witnessed the growth of many sciences to maturity, of some to perfection. Mathematics and chemistry, the most complete and extensive as well as the most valuable instruments by which the dominion of man has been extended over the powers of nature, have long attained a degree of certainty, beyond which their advancement may seem rather an object of curiosity than of use. Every branch of physical knowledge has been explored with a success that has seldom failed to reward the toil of the inquirer; the art and science of logic and the philosophy of mind have long assumed their places in the rank of exact sciences. The effect of this advancement of knowledge has been for ages apparent, and is daily more obvious in the increase of wealth, the multiplication of securities against evil, and the production of fresh means of enjoyment; but in the distribution of these good things, a very small class of the community lays claim to a lion's share, and the poor "are sent away empty." It is plain, therefore, that none of these are the sciences by which the misery that has always marked the lot of the lower classes can be removed. It is equally plain that to the discovery of the means of removing it the resources of the human mind should be intensely applied. To such discoveries we look forward with confident hope, but this hope is founded solely on the expectation of the diffusion of sound principles of hygiene.

The principal sources of happiness are the social affections; but the man whose thoughts are perpetually harassed by the torment of immediate or the dread of future want, loses the power of benevolent sympathy. Another result of suffering is, that it produces an extraordinary greediness for immediate gratification; a violent propensity to seek compensation from any sensual indulgence which is within the reach. As a consequence, the poorest individuals in civilized society are generally the most intemperate; the least capable of denying themselves any pleasure, however hurtful, which they can command. Hence their passion for intoxicating liquors.

There is really no *a priori* cause why the poor more than others should be addicted to intemperance, unless it be a sense of their own misery, superinducing a condition—a disease it may be called—which craves for stimulants. It might be well if our social reformers would regard the prevailing intemperance of the laboring class from this point of view, for it is quite certain that it is an incredibly fruitful, if not the chief, source of it. Our great industrial class is entitled to be cared for and protected, both as to their health and the pursuit of their avocations. They are the backbone and sinews of the nation's strength.

We cannot consider here the loss, in an economical point of view, from intemperance. It would amount to many millions of dollars. But what of the useless waste of life and its attendant sickness? of the consequent impoverishment, pauperism, and demoralization, and the increasing legacy of hereditary disease? There are two primary and fundamental considerations upon which natural stability and permanancy rest. The first regards the health of the people, the other their education. Any system of government without full provision being made for these will be incomplete; and in regard to the former, the best guaranty of a nation's security will be wanted. Therefore, above all things, let no government, in its administrative capacity, be without a health department, presided over by wise and energetic health officers, whose supreme duty it shall be vigilantly to administer laws, the aim of which shall be to protect the health of every citizen, and especially to surround that of the dependent, industrial population with every possible safeguard.

A nation such as ours, of fifty-five millions, with a vast manufacturing industry, a busy and flourishing commerce, and a large agricultural and mining interest to attract the most vigorous and enterprising of our people, cannot afford to waste the lives of its citizens. Are not labor and capital the two pillars upon which a free country rests? Disease paralyzes labor and wastes capital. It ought, then, to be the primary object of an enlightened government to prevent disease, preserve health, and prolong life; to maintain the whole people in a condition of the highest efficiency, alike for the labors of peace and the struggles of war.

Though "social reform is in the air," never before was the misery of the very poor more intense, or the condition of their daily life more hopeless or more degraded, than at the present time. There is a boundless field for the labors of the plilanthropist; and it does seem strange,

that, while the sufferings of the heathen in distant lands should unfailingly touch a chord of enthusiastic generosity in the hearts of all religious sects, the mission at home should awaken the coldest response. The courts and alleys of our crowded cities too often furnish a spectacle of squalor and misery which is a disgrace to our civilization, and should arouse public misgiving and inquiry. It is here that persons must come who wish to see for themselves what destitution and degradation are. It is here that the fever dens are to be found which figure so largely in perfunctory official reports. Here reside a population which is a people in itself, ceaselessly ravaged by fever; plagued by the blankest, most appalling poverty; cut off from every grace and comfort of life; born, living, and dying among squalid surroundings, of which those who have not seen them can form no adequate conception. The atmosphere in these courts and alleys is in almost every case foul in the extreme; and in the houses, unless one has a very strong stomach, it is difficult to remain for a minute, so intolerable is the stench.

These houses are filled with women, and diminutive urchins "engaged in the pleasing occupation of stirring around the filth in a sewer with their fingers." They evidently know what they are born to experience, and deem it advisable to accustom themselves to dirt and bad smells at as early an age as possible. They will declare "there is no sickness in the house," when you know certainly to the contrary. A further inspection reveals the fact that in an upper room, on a bundle of filthy rags, in one corner, the eldest son perchance is "down with the fever," and in another, on a still sparser supply of rags, a little girl,—it may be she is fast dying of diphtheria. Mark Twain once declared that he had been up a mountain so high that he could not tell the truth on the top of it. You will readily perceive that the people who occupy these dwellings are so poor, so dirty, so degraded, and so low in the scale of Christian civilization, that they cannot tell the truth; and if you should stay long enough amongst them, you would soon begin to entertain doubts of your own veracity.

The vast wealth created by modern progress has run into the "pockets" of the fortunate few; but the great majority of the "toilers and spinners" have derived no proportionate advantage from the prosperity which they have helped to create. It is true that many members of the working class, who have the moral and intellectual qualities essential to material success, have had their full share in the prosperity of recent times. Numbers of them have risen, and others will rise, into the rank of capitalists; but there is good reason to believe that the lowest dregs of the population in large cities are constantly exposed to the direst extremities of want and suffering—a circumstance which affects injuriously their life, their health, and their prosperity. There must, moreover, always be a residuum in any community—recruited frequently from higher classes, as the inevitable penalty of individual vice, recklessness, or calamity—which no amount of general prosperity, no ingenuity or drastic severity of legislation, can wholly extripate; but much is to be gained by grap-

pling, in a proper way, with the evils which actually exist. The wretched dwellings of the poor, together with poverty, ignorance, and crime, are a chief incident in the general condition of this class. These various factors are interdependent, and any one may be the determining cause of the others. The remedies, therefore, must be as manifold as the disease.

With regard to the direct and immediate means of dealing with the evils of overcrowding in the dwellings of the poor, Mr. Chamberlain, of England, goes to the root of the matter, and speaks out with uncompromising plainness.

In the first place, he would have the authorities proceed on the assumption that the houses which are unfit for habitation are public nuisances, and that the community in such cases should justly compel the owner to put them in proper condition, or require them to be closed or demolished.

It is certain that much more is capable of being done than has yet been undertaken, to require the owners of these shameful dens of vice and disease to keep their property in good sanitary condition. If overcrowding were strictly prohibited under the penalty of a heavy fine, it would seem that all these nests of crime and misery might be at once closed out, and their reëstablishment in other localities be prevented by the due enforcement of proper regulations.

For this purpose municipal authorities must have the hearty and consistent support of public opinion. When property takes alarm, the outcry which it makes is deafening. Personal interests can generally take good care of themselves: it is the public good which is so often powerless and voiceless in presence of the audacity of private wrong. A municipal government, charged with the protection of these undisciplined and disorganized natural rights, has no chance against the eager, persistent, and vociferous clamor of the vested interests with which it has to contend; and the experience of health officers, in their endeavors to enforce the most moderate precautions for the preservation of health and the safety of life, has not been encouraging.

Whenever, for the purposes of sanitary improvements, or where property has been declared unfit for human habitation, it has been necessary for the authorities to interfere, the owner generally obtains from the public, under the guise of compensation, amounts altogether and demonstrably in excess of the market value of the property, even on the most favorable compensation. Surely the sound principle in such cases should be the real value of the land and buildings, used under legitimate conditions, and not the exorbitant value arising from criminal practices. For example: There is a certain class of property found in unhealthy, crowded areas, and used for immoral purposes actually prohibited by the law; but the illegal occupation is the justification of the exorbitant rents demanded from the wretched occupants by the persons who trade in their vices. A house which for honest occupation is worth $200 a year, will bring in double or treble that amount to an owner who winks at the traffic which it is permitted to shelter.

When this house is required by the municipal authority, the demand for compensation is based, and often allowed, on an income which represents, not a fair return for an investment, but the profit on complicity with vice. The same result obtains where tenements, which could properly accommodate a single family, are made to do duty for three or four times as many persons as can be decently housed in them. The income derived is proportionally increased, and compensation follows as a premium on evil practices. In this way a premium is offered for neglect and wilful indifference to sanitary provisions. It is a question simply between the rights of property and the rights of the community, and until this fact is faced, no reform is possible; and it may be laid down as the principle of future effective action that to make certain localities in cities habitable for the toilers who live in them, the expense must be thrown upon the property-owners.

When these owners, not satisfied with reasonable rents and the increment which the general prosperity of the city has created, obtain exorbitant returns from their investments by permitting arrangements which make their property a public nuisance and a public danger, the state is entitled to step in and protect the citizen, paying only such compensation or damages as will fairly represent the worth of the property legitimately used. It is very well worth the while of the public to face this question and solve it. It would be of great benefit to all, and especially to the working population. It is not only a waste of life, but a waste of money, to educate the growing population, and send them to live in such miserable dens as they are often obliged to live in. The welfare of society demands that this matter of the housing of the poor shall be trifled with no longer. Public opinion is beginning to assert itself, and the prospect of action draws nearer daily.

The following project of a law is presented with the hope that, if applied, it may effect some good in promoting sound and trustworthy ideas upon this vitally important question, and bring within closer range the possibility of thoughtful and effective action. It possesses not only a large element of intrinsic justice, but if enacted would have the effect of placing upon the owners of unsanitary property a responsibility which undoubtedly belongs to them, and would be incalculably more effective in rectifying the evils of overcrowded tenements than all the "peddling" legislation of municipalties, or an army of sanitary inspectors.

1. The law should make it an offence punishable by heavy fine to own and rent property for habitation which is unfit for the purpose.

2. Local authorities should have power, subject only to appeal to the courts of proper jurisdiction, to close such property, or to make, at the expense of the owner, such alterations or repairs as may be ordered by the sanitary officer. The property to be closed during litigation.

3. When necessary to acquire any property or destroy any building, for the purpose of preserving or protecting the public health, or for any sanitary purposes whatever, the local authorities should be empowered to acquire the said property or destroy the building, without the city having to pay more than a fair market value for the same, to be settled by proper arbitration, but in no instance should the value assessed be greater than

the seller could obtain in the open market from a private purchaser, with no allowance for prospective value or compulsory sale. Provision should also be made to prevent owners from exacting extortionate prices for their tumble-down houses, often bought for speculating upon the necessities of the city or community.

4. The owner should be required to prove before the arbitrators, not what the nominal rent is, but what the actual rent received during a given period has been, and the amount of purchase-money may be estimated on that basis, unless the house has been used for improper purposes, or by too large a number of tenants.

5. The valuation should be made in every case, where an agreement cannot be arrived at between the parties, by official arbitration, and no appeal should be allowed from the decision.

6. The scheme of improvement should include any surrounding property which will be benefited by the reconstruction of the unhealthy area, and the confirming order should authorize a rate to be levied on the owners of such adjacent property, fairly representing the appreciation of their holdings by the proposed improvement.

7. The cost of any scheme for the reconstruction of an unhealthy area should be levied on all owners of property, including long leaseholders within a certain district to be determined by the arbitrators; but if the improvement is essentially local in its character, and the nuisance is created solely by the condition of one or more houses, the cost may be thrown entirely on the owners of such house or houses.

The effect of these or similar provisions would be simply that improvements on a large scale, and in every large town, could be undertaken by the authorities without fear of excessive cost. This is the age of municipal reform and enterprise; and there is not the slightest doubt that local authorities would, under these conditions, joyfully embrace the opportunity afforded to them, and that they would quickly put an end to the scandal and disgrace which have at last forced themselves on public attention, and alarmed and shocked the public conscience. It remains to be seen whether practical effect can be given to the only measure which affords hope of permanent relief. Political power is the means to the end of solving some of those social questions which intimately concern the welfare of the masses of the people, and in the settlement of which they have a just right to make their voices heard.

XIX.

HYGIENE OF THE HABITATIONS OF THE POOR.

By Major SAMUEL A. ROBINSON.

Through the invitation of the president of the American Public Health Association, I come to take part in your deliberations, and to present the opinions and views which an experience of six years in connection with the health department of the District of Columbia has enabled me to form on a subject that appeals alike to the philanthropist, the scientist, and the landlord. I shall attempt a practical statement of the errors that have been committed in the construction of the habitations of the poor, errors which, I am satisfied, have bred great distress, disease, and death among this particular class of people; and will also endeavor to point out the improvements necessary to render their homes and places of abode what they ought to be to insure comfort, cleanliness, and health. While most of the ideas I may offer are new to the average householder, since they refer to that part of house-building hidden from view, yet I am quite aware that to many here the story has been told oftentimes before, and by men who are much my superiors in scientific attainments, together with larger experience in this important branch of study. I venture, however, to occupy your attention, hoping to promote such a discussion as will develop and accentuate the knowledge we already have, and encourage an interest not only on the part of those present, but so stimulate the efforts of sanitarians and persons having sanitary authority all over the country that a change and a reform may be brought about in the construction of the tenement-houses, school-houses, and workshops where the poorer classes live and congregate. Laws thus procured by our influence should be made to apply with equal force to the buildings constructed before the enactment of laws regulating the drainage and plumbing in new houses. Where we have not sufficient authority, let us make it so plain by our work and our reports that the proper authorities may acknowledge the necessity for additional legislation, and urge the passage of laws by every municipality in the land, requiring the most stringent regulations governing all classes of work in connection with the habitations of the poor, affording besides to tenants who exercise ordinary care the requisite facilities for keeping their houses in good sanitary condition. The ignorance, want of proper training, and recognition of the rules of sanitation on the part of this class of people, render it of vital importance, not only for their own preservation and health, but for the comfort and health of their more affluent neighbors, that landlords should be compelled to supply them with proper house

accommodations, and that suitable means should be adopted for their education in sanitation. This latter purpose can only be accomplished through the medium of the most rigid house inspection, and the infliction of penalties for violation of rules of health when their acts or neglects are the means of injury to others than themselves. These are practical questions for our consideration, which must be approached in a practical way, and by minds capable of appreciating the full force and effect of the existing evil system, as well as grappling with the difficulties which attach to it.

The community has obviously the right of self-protection by restrictions upon the construction of the dwellings of its inhabitants, as well as a supervision of its food and water-supply, and the removal of waste. It is for the protection of communities that the profession of sanitary engineer (a coinage of quite recent date) has been brought so prominently to the front, and specialists and scientists in the medical and other learned professions are eagerly searching for new truths and formulating new regulations in this problem of self-protection. The rich encourage the enforcement of all reasonable sanitary regulations, the well-to-do citizens are generally offering no obstruction, while the poor resist every new or unusual investment which adds to the cost of living. The poor are, in a measure, the wards of the community in which they live, and no unnecessary hardships should be laid on them,—nothing beyond the plain requirements of sanitary laws should be insisted upon,—and, above all, the poor should be spared the burden of experiments. New and untried theories should be tested at the expense of the rich.

If we consider the dwellings of the poor in my own city of Washington, we will find small houses, usually occupied by a single family. Houses of recent construction, though not generally secured from the noxious air rising from the soil, and otherwise cheaply built, are all provided with separate and secure drains of heavy cast-iron, amply ventilated and trapped from the public sewers. Houses in the outskirts of the city, of earlier construction, are generally unprovided with drains, privy boxes being in common use. Where ground is cheap and plenty, as in Washington, this system of separate tenants will fortunately continue the rule, and secure construction becomes very simple. The choice of site, which is the first consideration, should be governed by the presence or absence of dampness; and the municipality should prohibit the erection of houses on a damp foundation until the evil is corrected by efficient sub-surface drains. Where these drains discharge into the sewer, the nicest care should be exercised to prevent the return of sewer air. Such drains should be of agricultural tile, laid with open joints at top, with loose covers to prevent obstruction of the joints, using care to leave no opening through which rats or mice may pass. Water so collected should be discharged into a cemented well of say two gallons capacity, from which a three-quarter inch lead or galvanized pipe, having a metal ball similar to Cudell's trap, may connect with the public sewer. The absence of dampness being secured, the modest structure, generally

consisting of four rooms, all with ample light, may be erected. The chimneys should be sufficient for the escape of smoke and for the ventilation of the apartments. The entire surface of the ground within the walls of the house should be covered with four inches of Portland cement, to prevent the rising of ground air. Such work is usually very carelessly done, or entirely neglected; yet it is of prime importance.

It is desirable that each house should have a separate connection with the public sewer. This drain should be of four-inch cast-iron pipe well tarred, with a running trap outside of house, and fresh-air inlet for ventilation. The vertical extension should be four-inch cast-iron pipe, or wrought iron, with screwed joints, carried full size above the roof of the house. Where the combined system of public sewers exists, the rain-fall and house sewage are discharged into this drain.

The number of fixtures, such as sinks, water-closets, and bath-tubs, are regulated by the ability of the occupants of the house. It is chiefly the water-closets with which we have to do, though the waste connections of every fixture are subject to municipal regulations, and guarded with equal care. Each water-closet must have a flushing tank, with ample arrangements for efficient flushing of the traps. Every fixture having connection with the drains should be exposed for inspection, where practicable. Water-closets, sinks, basins, etc., should not be boxed about. Water-closets should be entirely of delf-ware, with ample flushing rim and trap of same ware. Cast-iron or other metal traps should be prohibited. Valve closets of every description, from the old pan closet, with its receiver loaded with excremental filth, to the newest patent side outlet, ball-valve sanitary closet with germicide attachment, should be abated or prohibited. The simplest are the best. The class of closets known as wash-out closets are numerous and reliable. The syphon closets and short-hoppers, with delf-ware traps above the floor, give sufficient variety for selection, and all others should be avoided.

An important question connected with the healthfulness of dwellings is the mode of carrying off human excreta, garbage, and ashes. I think a contract made with one party for the removal of all this refuse is the safest, he to utilize it as he deems best, but to be subject to the most stringent rules of the health department as to the manner in which his work is done. Earthen-ware receptacles, glazed on the inside, somewhat smaller than the wooden box commonly used, should be adopted, and so located in an outhouse as not to be exposed to the rain or weather, and the tenant required every day to sprinkle a small quantity of ashes over the contents; and this box should be cleaned at least every two weeks by the contractor. The system of requiring tenants to pay for removals is a bad one, as it entails an expense that many of the poorer classes cannot afford, and tempts them to resort to all kinds of tricks to escape. Sometimes the ordure is buried in the ash pile, and often in the sewer traps of the nearest alley. It can be removed in an odorless way by means of pump, hose, and air-tight barrels, having an opening in the head of barrel the size of an ordinary hose coupling.

Ashes should be taken away by the contractor as often as it is necessary to remove the garbage. It is not safe to allow the garbage to remain longer than two days at a time on any premises, although it is a common practice to regulate these removals by the size of the dwelling. The poorer classes invariably make a nuisance of this refuse, either by holding it for a country cousin who owns hogs, or, when it accumulates beyond the capacity of the small receptacle they may have for it, by dumping it in the alley or on the nearest vacant lot, creating a nuisance injurious to the health of the entire neighborhood. For these and other reasons, the removals should be frequent and prompt, and the contractor should be held strictly to a faithful performance of his duty or forfeit his contract.

Garbage should be removed in iron-bound barrels having close-fitting covers. All excreta and garbage should be quickly carried out of the city to some remote locality in the country, where it should be placed in a pit mixed with earth, and returned to the soil for fertilizing purposes. Various analyses show it to be six times more valuable than the excreta of the horse, and eight times that of the cow. All that we need is a safe way for its collection and disposal, and a more scientific method for preventing its deterioration. Liebig, in his work on chemistry in its application to agriculture and physiology, says,—"The Chinese are the most admirable gardeners and trainers of plants, for each of which they understand how to prepare and apply the best adapted manure. Very little value is attached to the excrements of animals. Indeed, so much value is attached to the influence of human excrements by these people [the Chinese] that laws of the state forbid that any of it should be thrown away, and reservoirs are placed in every house in which it is collected with the greatest care, and the vessels are removed daily as carefully as our farmers remove the honey from the hives."

The construction of the mammoth tenements for the poor in our principal cities is a more complicated matter. To secure light and ventilation for each apartment; to have all rooms containing plumbing fixtures with direct openings to outside air and light; to preserve privacy in the use of such fixtures; to allow ample hall-ways for the decent isolation of the families; to give sufficient stairways, independent of the elevators, for escape in case of panic from any cause; to obtain open grounds for healthful exercise; to guard against the loss of life by fire; to furnish storage and facilities for handling fuel, as well as laundry and drying space; to avoid the use of deleterious wall-papers; to protect each tenant from pollution of the atmosphere of another apartment by communication through the hall; to supply all safe and proper appliances for heating rooms; to provide convenient means for the removal of garbage and ashes,—are all of prime hygienic importance.

There should be no scrimping of the public money whenever there is a demand for it by a competent board of health, but the most liberal appropriations should always be made for this, the most useful branch of the public service. The sanitary laws should be rigidly enforced, and there

should be no waiting for an epidemic to awaken us to a sense of our duty, and then cause us to expend large sums of money in cleaning foul places which should always have been kept clean.

Prof. W. H. Brewer, in his paper to the common council of New Haven, expresses himself most forcibly upon the subject. He says,—

> Cases might be cited where a pestilence has proved a blessing in the end by scaring people into the means for promoting the public health, and thus greatly lessening sickness, lowering the death-rate, and educating the people into living more cleanly lives. Suppose that a tenement-house in this city were on fire, its inmates in danger, and the physical means of saving their lives were simple and at hand, but the firemen had neither the legal right nor the legal power to use them: if but a single life were lost, laws would soon be made to suit similar emergencies in the future. Or suppose the firemen were legally prevented from using such methods as they knew had been effective elsewhere, and the victims left helplessly to perish: how long would it be before the cruel laws would be repealed? Yet every year we see many lives lost, not only in tenement-houses, but also in the houses of well-to-do citizens, from diseases induced or aggravated by bad plumbing, faulty drainage, or other preventable causes, whose lives might have been saved were the people as wise and alert in sanitary matters as in that of fire, and public opinion as earnest in maintaining organized protection against the one class of dangers as the other.
>
> We now want some of the legal safeguards erected against the danger of slow death by preventable disease, which are already provided against sudden death by accident. We have guarded against the lesser causes of preventable death: now let us be equally earnest and enthusiastic in guarding against the greater danger, that from accumulated and accumulating filth. We want a plumbing and house-drainage law, with the means and power for its due administration. We want a law forbidding the building of any privies or cesspools on sewered streets.

Exceptionally strong powers are conferred upon the health authorities in the city of New York, and yet they have been slow to act in regard to the swarms of Italians, Polish Jews, Chinese, and Irish in some of the tenement-houses in that city, notwithstanding the earnest protests of the *Sanitary Engineer*, a journal ever foremost in the cause of sanitary reform, and always abounding in information invaluable to every household. The owners of all buildings of this character should be found, and forced either to tear them down or make them habitable. Experience teaches us, wherever stringent means have been adopted requiring tenants to occupy other quarters and to live more in accordance with the customs of civilized beings, that these houses, when condemned and unoccupied, have soon been levelled to the ground, and new, substantial, and healthful houses for the poor have taken their place. It is the duty of every municipality to act now just as they would be compelled to do if the cholera or yellow fever were raging in their midst, with a death-roll of two thousand a day. Disease that always takes its rise in the habitations of the poor, at this moment hovers over the palace of the pope of Rome. In the cities of Toulon, Naples, and Marseilles the poor revel in filth. Death has held a carnival in the beautiful cities of France, where the wealthy of all nations resort for pleasure and recreation. What city in the country should so shrink from the desolating presence of cholera as St. Louis, the Queen of the West, whose experience has been so direful in the past? Who can forget that

in 1849 whole families of the wealthiest and the best of the land were swept away by this wasting pestilence? Are we in a condition to meet this dreaded visitor next year? Remember, that cities which have adopted and strictly enforced sanitary laws have in a measure escaped disease.

The three great works on which the future of Washington city depends—the improvement of the sewerage system, the increased water-supply, and the filling in of the flats—are being pushed forward as rapidly as the appropriations by congress will admit. As a result of these and other improvements, capitalists will continue to invest in Washington city real estate, beautiful houses will be built, and the taxable property will rapidly increase. As this march of improvement goes on, we must not lose sight of the dark spots upon this bright and beautiful picture, but strive to root out the ragged fringe of dilapidated frame shanties on the outskirts of our city, and encourage capitalists to invest in new and healthful habitations for the poorer classes. We confidently expect congress, at its next session, to give us the power to regulate the sanitary conditions of all houses, old as well as new;—then, and not till then, can Washington be called a perfectly healthy city.

"I once took a distinguished statistician of France," says Dr. Southwood Smith, "to some of the habitations of the poor in London, and showed him the sick with typhus lying in their wretched beds—for the sick with typhus may be seen there every day of every year. After the painful inspection he exclaimed, 'England is indeed adorned with a splendid mantle, but under it are concealed the greatest horrors.' Determined that this eminent person should see both sides of the picture, I next took him to see the model dwellings. What are the model dwellings? Small plots of civilization in the wide waste of barbarism. In what does this civilization consist? In very simple matters. The subsoil drainage of the site of the building; the free admission of light and air to each inhabited room; the abolition of the cesspool, involving complete house drainage; an abundant supply of water, and the immediate removal by it of all refuse which it is capable of holding in suspension; and means for the removal of house refuse not capable of suspension in water. And this is all. And what are the results of these few and simple arrangements? That the mortality among the inhabitants of these dwellings is less than that of London generally, and far less than that of some of the filthy and neglected localities of London; that there has not been a single death from typhus, or any other form of continued disease, among the adults, in any of these buildings since their establishment. Such are the results of the first imperfect attempt at improvement, which, remarkable as they are, are not more striking than the results of neglect. We see the first steps that must be taken to elevate the people,—nay, even to bring them within the pale of civilization already attained. We must improve their sanitary condition. Until this is done, no civilizing influence can touch them. The school-master will labor in vain; the minister of religion will labor in vain;—neither can make any progress in the

fulfilment of their mission in a den of filth. Moral purity is incompatible with bodily impurity; moral degradation is indissolubly united with physical squalor. The depression and discomfort of the hovel produce and foster obtuseness of mind, hardness of heart, selfish and sensual indulgence, violence, and crime. It is the home that makes the man; it is the home that educates the family. It is the distinction and the curse of barbarism that it is without a home; it is the distinction and the blessing of civilization that it prepares a home in which Christianity may abide, and guide, and govern."

XX.

THE SANITARY SURVEY OF A HOUSE.

By WILLIAM K. NEWTON, M. D.,

HEALTH OFFICER OF PATERSON, N. J.

In every village, town, or city there are buildings denominated, by the older and more superstitious residents of the place, "haunted houses;" that is, some murder, crime, or mystery is so connected with the history of the house as to bring it into disrepute, and the spirits of the departed are supposed to hover around the house and make it untenantable. And so there are, in every village, town, and city, certain houses which, by reason of their history, may well be called, by sanitarians, haunted. In some, whole families have been swept away by consumption, caused by dampness of the soil under and around the dwelling; or in others, faulty plumbing or foul surroundings have caused the death of the younger members of the household, from diphtheria or some other filth disease.

Fortunate indeed would it be if the spirits of the departed would warn prospective tenants away from these fated dwellings, or induce the owners to set their houses in order and look well to the surroundings. But there are no ghostly monitors to point out the unhealthful houses or sites: hence we must look to those more tangible mentors, our local health authorities, to perform this kindly work.

Recognizing, then, that an important duty to be imposed upon the health boards is the proper inspection of dwellings with regard to their healthfulness, let us outline a plan to be followed in this work. To obtain a history of each house in a city or town would be a difficult task, if no system were employed; but, on the other hand, the desired facts could be collected with ease if a comprehensive form be used, by means of which important points are noted.

As it was the intention of the Board of Health of Paterson, N. J., to make a sanitary survey of at least a portion of the dwelling-houses in that city, we set about to prepare a list of facts concerning which information was desired. At first thought this seemed an easy exercise, for it was supposed that such a form could be found ready at hand, in some treatise or report on sanitary subjects; but as the plan developed by study, it was ascertained that no scheme for the sanitary survey of a house had been published:—hence our form had to be evolved, and built up from the foundation. This proved to be a very interesting task, and

the writer herewith offers the schedule which resulted from his study of the subject, with notes thereon, hoping that it may assist other students of public hygiene, and perhaps excite discussion, and thus draw attention to the strong and weak points in it.

My object was to draw up a schedule that would contain all the facts that might prove of value in estimating the sanitary value of a house, and at the same time present these facts in such a shape that they might be easily employed in the work of inspection: hence the form is printed out, so that all the inspector has to do is to draw his pencil through certain words, or underscore others, thus rapidly completing the work.

I shall now take up the various points to be considered in what seems to be their natural order.

First.—We should examine the sanitary condition of the street on which the house faces.

THE STREET.

Under this head note the direction the street runs, whether north, south, east, or west, for the information thus derived bears on the amount of sunlight a house receives: for instance, a house which faces the north will receive none of the morning sun in the lower rooms. Next, note the width of the street; for a narrow street, with high buildings on both sides, would not allow much circulation of air nor play of sunlight, and the street and the lower stories of the houses would be damp.

The grade of the street also is of importance, and has to do with the rapidity with which surface-water runs off, and hence bears on its cleanliness and dryness. The condition of the pavement also has much to do with the healthfulness of a street; for, as Dr. E. J. Marsh puts it, "the condition of a street for convenience of travel runs closely parallel with its condition as to cleanliness, and the streets in worst repair are generally the dirtiest, and an unpaved street in a city can scarcely be kept clean."

The gutters also claim our attention; for those made of rough or cobble stones allow much filthy material to collect in the spaces between the stones, and cannot be kept clean.

Notes on the sewer in the street should be taken, and should comprise the material of which it is built,—the size, shape, depth below the surface, fall, and whether it is competent or not.

When these notes are down, we may then easily sum up and express an opinion as to the sanitary condition of the street.

Before leaving the street, it would be well to observe the presence or absence of shade-trees,—how close they are to the house, and whether they interfere with the lighting of the house. In wide streets, with the house well set back from the sidewalk, shade-trees are of great value, as they keep off the glare of the sun, and temper the air very much; but in

narrow streets they are a positive detriment, for they are apt to cause dampness in the front rooms and basement of the house.

Next we examine that important subject,

THE SITE OF THE HOUSE.

We note down under this head how high the site is above sea-level; whether the soil is gravel, sand, rock, clay, loam, or made ground; whether it is the site of an old water-course or swamp. Is the site damp? and has it been drained? If so, how? All these facts have the most important bearing on the healthfulness of a house; for we cannot expect a house built upon a damp soil, or upon made ground, or ground filled up with organic matter, to be in a good sanitary condition.

Before going into the yard, it would be well to make a diagram of the site, and to put down the outlines of the house, and also the position of the well, cistern, cesspool, privy, and the drains.

THE YARD.

Going into the yard, we observe whether it is paved and drained; whether slops and garbage are allowed to accumulate; how the privy-vaults or cesspools are constructed, and if offensive, and how far these are from the well or cistern.

The water-supply, whether from the city mains, well, or cistern, should be examined into. If from well or cistern, an analysis should be made. Sources of contamination should be found out.

Observe, also, whether cattle, goats, or fowls are kept in the yard, and whether any nuisance exists on the lot, or on the adjoining property.

THE HOUSE.

From an external inspection, we note how the house faces; the number of stories; the material of which it is constructed; and the kind and quality of the roof. If the house is of wood, observe if it has been properly sheathed before the clapboards were put on, and whether "fire-stops" were put in.

The size of the house, and the ratio of unoccupied space on the lot, are of importance; also, whether there are any back buildings.

We next visit the cellar, and notes are taken as to its height, construction, and condition. How is the foundation built—of stone, brick, or rubble? Is there any damp-course? How far below the sidewalk is the ceiling? Are windows provided for light and ventilation? Is the cellar floored or concreted, and is it dry? Is it used for a dwelling, or sleeping-room, or work-shop? The condition of the water-closet, if in the cellar, should be looked after, for it will generally be found to be filthy.

The ventilation and lighting of the house are to be next considered;

and the existence of rooms not provided with a communication with the external air should be looked for.

The methods of heating should also be noted down.

Under the head of plumbing and drainage, full and careful notes should be taken, for more defects will be noticed here than elsewhere in the dwelling. We observe whether the house is connected with sewer or cesspool, and if so, by what means; and if the house is separated from the sewer or cesspool by a vented, running trap, properly situated. A searching examination should be made for all defects, and proper tests applied to learn if any leaks exist.

When we shall have completed our notes on the house and its surroundings, we then jot down the vital statistics, such as the population, number of families, number to each family, number under five years of age, and number of rooms used by each family.

Now comes in a very important series of facts relating to the amount of disease, or the number of deaths in the house under inspection; and the accuracy and usefulness of our deductions depend on the care with which the records are kept by the local health board. To be of any use to society, the vital statistics of a town should be kept and used by the local health authorities in a systematic manner. The returns of deaths, and of cases of contagious and preventable diseases, should be so tabulated that the sanitary officer may at any time tell the condition of any house in the town. If, for instance, cases and deaths, of dysentery, diphtheria, or typhoid fever, occur frequently in a certain dwelling, a strict search would, in most instances, reveal the cause; and thus we might be enabled to avert trouble in the future.

Intelligent sanitary administration is made so by attention to minor details; and a health officer can do efficient service if he appreciate the use of the vital facts at his command.

But, without going more into detail, I have said enough to show that there are a great many things to be looked after when inspecting a house; and had I prepared this paper for popular use, I would have given reasons for each one of the facts noted. To an audience of sanitarians it does not seem necessary to tell why so many points have been insisted upon.

In closing, I would apologize for offering this fragment; but the hope that some health officer would be set to thinking has prompted me to present it.

I append the schedule prepared for the Board of Health of Paterson, N. J., upon which this paper is based.[1]

[1]Since writing, I have been favored with a form for the sanitary inspection of a tenement house, prepared by Mr. F. N. Owen, inspector for the New York Tenement Commission. This is a very comprehensive and complete form, but it is mainly applicable to large houses in our great cities.

SCHEDULE FOR THE SANITARY SURVEY OF A HOUSE.

(The inspector will cross out all but the correct words, and will fill in spaces.)

Date . . . .

. . . . Street, Number . . . .

Street runs N., S., E., W. *Width* . . feet. *Grade* . . . . . .

Pavement.—Cobble, block, Macadam, Telford, none.

Gutters.—Paved, curbed, smooth.

Sewer.—Material, brick, pipe . . . . . ; size . . . . . ; shape . . . . ; depth below surface . . feet; fall . . inch to . . foot; runs into . . . . St. sewer; condition . . . .

Condition of street and gutters . . . .

Shade-Trees.—How far from the house . . . . . ; prevent sun exposure? . . .

SITE OF HOUSE.

. . . feet above sea-level.

Soil.—Gravel, sand, clay, loam, rock, made ground, filled in with . . . . ; site of swamp,—old water-course, pond; damp, dry. Was site drained before building? . . . . ; how? . . . . ; is surrounding land higher than site, or lower?

DIAGRAM OF LOT.

w.—well.
c.—cistern.
p.—privy.
c. p.—cesspool.
c. b.—catch basin.
- - - - drain.

FRONT.

Width of alley, if any.

Yard.—Paved, flagged, cemented, drained, clean, slops, garbage.

Privy-vault.—Stone, brick, board, none, water-tight, connected with sewer, supplied with water, clean; how near living rooms . . . .

Water-closet.—Style, clean.

Cesspool.—Stone, brick, tight, leaching, connected with sewer . . . . .

Water supply.—City, well,—depth of . . . . . . ,—cistern.

Distance of well from source of pollution.

Analysis of water.

HOUSE.

Owner.

Agent.

Tenement.—Private, boarding-house . . . .

House faces N., S., E., W.; sun exposure,—good, bad; 1-, 2-, 3-, 4-story; number of rooms . . .

Construction.—Brick, stone, wood; sheathed before clapboarding; . . . . fire stop . . . . . .

Roof.—Tin, shingle, slate, tar, gable, flat, French, leaky.

Scuttle . . . . . . fire escapes . . . . . .

Size of house . . . . ; size of lot . . . .

Ratio of unoccupied space . . . .

Back-building,—distance from house . . . .

Cellar.—Foundation,—stone, brick; how laid . . . . . . ; asphalted or cemented . . . . ; damp-course . . . . . ; depth below sidewalk . . . . . ; *floor*,—cemented, asphalted, stone, board . . . . . . ; dry, damp.

Water-closet,—condition.

Windows . . . . Is room used for sleeping-room, living-room, shop?

Ventilation of house.

Illumination.—Window space.

Rooms not connected with external air . . . . .

Heating.—Fire-place, stove, furnace, steam; has furnace an air box? . . .

Plumbing.—Is house connected with sewer or cesspool? . . .

Angle of connection with sewer.

House-drain.—Lead, iron, earthen-ware; size . . . . ; fall . . . . ; caulked joints, cement joints; how fixed in cellar; under ground or exposed.

Main trap . . . . . inlet for fresh air . . . .

Soil-pipe.—Iron, lead, ... ; size . . . . . . ; joints . . . . . . ; angle of connection with house drained . . . . ; extend above roof.

Does ventilating-pipe run into soil-pipe?

Traps under fixture . . . . traps vented.

Water-closets.—Number . . . ;—pan, hopper, plunger, syphon . . . ; sufficient wash . . . .

Are there any adjoining nuisances?

Are fowls, goats, or cattle kept on premises?

VITAL STATISTICS.

Population of house.

Number under five years of age.

Number of families.

Number to each family.

Number of rooms to each family.

Diseases reported.—Scarlet fever, diphtheria, typhoid fever, dysentery, diarrhœal diseases, ...

Deaths.

XXI.

THE HYGIENE OF OCCUPATIONS.

By GEORGE H. ROHÉ, M.D.,

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The influence which occupations exert upon the health of the artisans engaged in them is a problem of vital importance to every one; for the law that man must eat his bread in the sweat of his face is not restricted to a class, but is universal in its application.

Notwithstanding the importance of the subject, very little has been done in this country up to the present time to elucidate the problem. On examining the nine portly volumes representing the work of this association, I find only two papers having any bearing upon the question. In addition to these, I have been able to find only twenty-two titles in American medical or sanitary literature in which the hygiene of occupations is considered. Of these, four are found in the annual reports of the New York city board of health for 1872, 1873, and 1874; three in the reports of the Massachusetts state board of health for 1872, 1874, and 1883; one in the report of the New Jersey state board of health for 1879; one in the report of the West Virginia state board of health for 1883; one in Transactions American Dental Association; eight in medical journals; two in reports of the U. S. marine hospital service; one in Buck's "Treatise on Hygiene and Public Health;" and one in the "Health Primer on School and Industrial Hygiene," written by Dr. D. F. Lincoln.

This paucity in the special literature of industrial hygiene in America is remarkable, when the diversified industries of the country are considered; for there can be no doubt that here, as well as abroad, the unhealthful or dangerous character of certain occupations is well recognized.

In this brief paper no attempt will be made to elaborate the details of unhealthful occupations. I shall merely endeavor to stake out, in a general way, the field to be cultivated by special laborers, giving some account, however, of the work that has already been done, and indicating the main causes of the dangers to health in certain avocations.

In the twenty-third registration report for Massachusetts appear the following tables, giving the number of deaths, and the average age at death, of persons following certain occupations in that state during a period of thirty-one years and eight months, the period ending with December 31, 1874. So far as I am aware, these tables are the only ones based on sufficiently and reasonably exact data that have been pub-

lished in this country. The first table gives the total number of decedents arranged into ten classes, while the second gives the details for each occupation represented.

TABLE I,

Showing occupations by classes, and average age at death, of 144,954 *decedents in Massachusetts, from May* 1, 1843, *to December* 31, 1874, *thirty-one years and eight months.*

Occupations.	Number of persons.	Average age at death.
All classes and occupations,	144,954	50.90
I. Cultivators of the soil,	31,832	65.29
II. Active mechanics abroad,	10,893	56.19
III. Active mechanics in shops,	16,576	47.57
IV. Inactive mechanics in shops,	17,233	43.87
V. Laborers—no special trades,	28,058	47.41
VI. Factors laboring abroad,	7,035	36.29
VII. Employed on the ocean,	8,844	46.44
VIII. Merchants, financiers, agents, etc.,	15,965	48.95
IX. Professional men,	5,175	50.81
X. Females,	3,343	39.13

TABLE II.

Occupations of persons whose occupations were specified, and whose deaths were registered in Massachusetts during a period of thirty-one years and eight months, ending with December 31, 1874.[1]

Occupations.	Number of persons.	Average age at death.	Occupations.	Number of persons.	Average age at death.
CLASS I. *Cultivators of the earth: Farmers, gardeners, etc.,*	31,832	65.29	Ship carpenters,	873	58.53
CLASS II. *Active mechanics abroad:*	10,893	56.19	Slaters,	81	40.99
Brickmakers,	106	46.85	Stone-cutters,	1,025	40.90
Carpenters and joiners,	6,150	53.33	Tanners,	537	50.36
Caulkers and gravers,	180	58.59	CLASS III. *Active mechanics in shops:*	16,576	47.57
Masons,	1,662	50.33	Bakers,	471	47.04
Millwrights,	118	59.14	Blacksmiths,	2,402	53.26
Riggers,	161	52.25	Brewers,	28	47.11
			Cabinet-makers,	781	48.84

[1] *Thirty-third Registration Report of Massachusetts*, p. CVII, *et. seq.*

TABLE II,—*continued.*

Occupations.	Number of persons.	Average age at death.
Calico-printers,	9	52.11
Card-makers,	39	48.23
Carriage-makers and trimmers,	276	48.21
Chair-makers,	138	41.77
Clothiers,	84	56.50
Confectioners,	85	44.11
Cooks,	112	40.82
Coopers,	927	59.22
Coppersmiths,	101	45.89
Curriers,	366	41.50
Cutlers,	131	39.21
Distillers,	27	56.85
Dyers,	143	45.17
Founders,	361	42.51
Furnace-men,	133	43.42
Glass-blowers,	132	37.88
Gunsmiths,	250	48.86
Hatters,	356	54.67
Leather-dressers,	179	47.23
Machinists,	2,097	41.67
Millers,	278	57.14
Musical instrument makers,	33	46.73
Nail-makers,	174	41.49
Pail- and tub-makers,	5	36.60
Painters,	1,850	45.07
Paper-makers,	288	48.29
Pianoforte-makers,	111	43.33
Plumbers,	131	35.53
Potters,	40	56.67
Pump- and block-makers,	89	54.79
Reed-makers,	9	42.78
Rope-makers,	248	58.05
Tallow-chandlers,	67	54.93
Tinsmiths,	375	41.05
Trunk-makers,	48	39.60
Upholsterers,	124	38.82
Weavers,	480	44.95
Wheelwrights,	507	56.98
Wood-turners,	76	52.07
Mechanics (not specified),	2,015	44.84
CLASS IV.		
Inactive mechanics in shops:	17,233	43.87
Barbers,	403	39.81
Basket-makers,	70	61.63
Bookbinders,	150	40.12
Brush-makers,	53	43.11
Carvers,	90	34.00
Cigar-makers,	154	38.36
Clock- and watch-makers,	100	52.86
Comb-makers,	134	51.38
Engravers,	124	40.88
Glass-cutters,	76	43.16
Harness-makers,	423	48.74
Jewellers,	468	40.34
Operatives,	2,138	39.16
Printers,	717	38.62
Sail-makers,	217	53.21
Shoe-cutters,	362	42.94
Shoemakers,	9,772	44.61
Silversmiths or goldsmiths,	92	46.13
Tailors,	1,393	47.34
Tobacconists,	43	50.35
Whip-makers,	99	42.63
Wool-sorters,	155	48.09
CLASS V.		
Laborers (no special trades):	28,058	47.41
Laborers,	27,382	47.49

TABLE II,—*continued.*

Occupations.	Number of persons.	Average age at death.	Occupations.	Number of persons.	Average age at death.
Servants, ...	389	40.10	Boarding-house keepers,	75	47.96
Stevedores, ...	76	52.09	Booksellers, ...	73	53.05
Watchmen, ...	193	50.06	Brokers, ...	198	49.58
Workmen in powder-mills,	18	39.67	Clerks and book-keepers,	3,435	35.93
CLASS VI. *Factors laboring abroad, etc.:*	7,035	36.29	Druggists and apothecaries, ...	255	42.37
Baggage-masters, . . .	37	34.08	Gentlemen, ...	1,512	68.42
Brakemen, ...	246	26.54	Grocers, ...	517	47.59
Butchers, ...	537	50.19	Innkeepers, ...	467	50.04
Chimney-sweeps, . . .	4	34.50	Manufacturers, . . .	1,373	51.53
Drivers, ...	327	38.88	Merchants, ...	3,927	54.17
Drovers, ...	17	49.29	Newsdealers and carriers,	27	41.22
Engineers and firemen, .	567	38.77	Railroad agents or conductors, ...	318	39.85
Expressmen, ...	216	41.30	Saloon and restaurant keepers, ...	299	40.90
Ferrymen, ...	9	53.78	Stove dealers, ...	12	45.25
Lighthouse-keepers, . .	10	60.40	Telegraphers, ...	5	28.80
Peddlers, ...	417	45.18	Traders, ...	2,908	48.08
Sextons, ...	81	59.94	CLASS IX. *Professional men:* . . .	5,175	50.81
Soldiers, ...	2,885	28.37	Architects, ...	29	47.07
Stablers, ...	354	42.54	Artists, ...	186	44.18
Teamsters, ...	1,282	40.35	Civil engineers, . . .	117	42.32
Weighers and gaugers, .	24	60.67	Clergymen, ...	965	58.57
Wharfingers, ...	22	50.00	Comedians, ...	32	37.31
CLASS VII. *Employed on the ocean:* .	8,844	46.44	Dentists, ...	114	41.61
Fishermen, ...	433	42.82	Editors and reporters, .	87	46.68
Marines, ...	4	41.25	Judges and justices, . .	18	64.11
Naval officers, ...	58	50.00	Lawyers, ...	676	56.45
Pilots, ...	82	60.38	Musicians, ...	266	41.59
Seamen, ...	8,267	46.45	Photographers, . . .	10	36.80
CLASS VIII. *Merchants, financiers, agents, etc.:*	15,977	48.95	Physicians, ...	1,166	54.99
Agents, ...	376	46.76	Professors, ...	45	55.93
Bankers, ...	49	57.61	Public officers, ...	437	55.37
Bank officers, ...	151	55.14			

TABLE II,—*concluded*.

Occupations.	Number of persons.	Average age at death.	Occupations.	Number of persons.	Average age at death.
Sheriffs, constables, and policemen, ...	158	53.76	Nurses, ...	116	61.06
Students, ...	288	23.23	Operatives, ...	703	27.82
Surveyors, ...	86	51.44	Seamstresses, ...	289	46.50
Teachers, ...	495	41.79	Shoebinders, ...	48	43.12
CLASS X.			Straw-workers, ...	73	34.83
Females:	3,343	39.13	Tailoresses, ...	233	47.49
Domestics, ...	1,037	46.64	Teachers, ...	442	31.27
Dressmakers, ...	259	43.36	Telegraphers, ...	7	24.43
Milliners, ...	136	39.42			

While the above tables cannot, for obvious reasons, be absolutely relied upon, they show clearly the relation of certain classes of occupations to the average duration of life. Table I shows, among other things, that the cultivators of the soil, persons who lead an active life in the open air, who generally live well, and whose occupation does not involve a constrained position of the body, have the longest expectation of life; that next to these comes the class of active mechanics out of doors, whose expectation of life is 9.1 years less than the last class. Professional men come next in order, with an average duration of life but very slightly below the average of all classes. In this class, however, clergymen and members of the bar (see Table II) have a very great advantage over their brethren of other professions. Mechanics who are engaged in active work indoors, may expect to live 3.70 years longer than those whose occupations require them to maintain a constant or constrained position. The class of "factors laboring abroad," which includes railroad employés, drivers, and soldiers (the latter, I think, improperly), has the shortest expectation of life, the average limit being 36.29 years. In this class, the early deaths are manifestly often due to violence.

Among the pursuits which cause frequent or grave derangements of health in the artisans, the following are the more prominent:

It is stated that nearly one half of the workmen employed in the manufacture of chlorinated lime become attacked by the symptons of acute or chronic chlorine poisoning. Pneumonias are exceptionally frequent, and individuals with tubercular predisposition rapidly succumb to consumption, lighted up in consequence of the effect of the irritant vapor on the lungs.

In the vulcanization of india rubber, and in the process of extracting oils from seeds and fatty bodies, bisulphide of carbon is extensively used.

Inhalation of the vapor of this compound causes a peculiar train of symptoms, first described by Delpech in 1856. The symptoms consist of headache, pains in the joints, troublesome cough, and some mental aberration. The sexual function is first exalted, and afterward entirely destroyed. The special senses are affected in a varying degree, resulting in a diminution of the power of sight and hearing, and localized anesthesias.

The fumes of turpentine may give rise to respiratory or digestive disturbances in those who are compelled to inhale them. Strangury, or even more severe disorders of the urinary organs, are not infrequent.

Workmen in lead, whether occupied in roasting and smelting the ores of the metal or in the manufacture or use of pigments containing lead compounds, in chemical manufactories, or in any of the occupations in which they are compelled to inhale an atmosphere containing lead in any form, frequently suffer from lead poisoning. The average duration of life of painters, according to table II, is 45.07 years; and about 75 per cent. of these artisans suffer from one or more of the poisonous effects of lead. The lead ore roasters and smelters live, on an average, only 41 years. In acetate-of-lead manufactories 60 per cent. of the employés constantly suffer from some form of lead poisoning. The various forms in which the toxic action of lead is manifested are the lead cachexia, lead paralysis, saturnine colic, and muscular and joint pains affecting especially the lower extremities.

The characteristic toxic effects of mercury are produced in the artisans who work with that metal. Mercurial-ore smelters live only 45 years on an average. Mirror-makers, fire-gilders, fulminate makers, and hatters[1] suffer severely from the inhalation of mercurial vapor or dust. Salivation and its accompanying effects; the mercurial cachexia, with its attendant nervous symptoms; the mercurial tremor and hypochondria, and phthisis, are the most frequent and grave manifestations of the poisonous effects of this metal. Of the total deaths among mirror-makers, 71 per cent. are from pulmonary consumption. Women exposed to the injurious influences of the metal frequently abort, and of the children born living, at term, 65 per cent. die within the first year.

Workmen in brass are liable to a peculiar nervous affection termed "brass-founders' ague." About 75 per cent. of those engaged in brass-casting suffer from it.

The inhalation of anilin vapor (from anilin oil, not anilin colors) may produce death, although in most cases a fatal termination is not reached. The symptoms are especially referable to the nervous system and the skin.

All persons compelled to inhale constantly an atmosphere charged with dust, either metallic, mineral, or vegetable, become affected in time with catarrhal or interstitial inflammations of the respiratory organs. Coal-miners, cutlers, file-cutters, nailers, blacksmiths, needle-grinders,

[1] L. Dennis: "Hatting as affecting the Health of Operatives," New Jersey State Board of Health Report for 1879.

etc., suffer to a very great degree from phthisis. The Massachusetts table gives the average duration of life for blacksmiths at 53.26 years; for nail-makers, 41.49 years; and for cutlers, 39.21 years. Dr. James E. Reeves states that several years ago he examined 136 nail-makers in Wheeling, and found only one in whom there was not some pulmonary affection. All the rest were so seriously affected that none of them would have been a safe risk for a life-insurance company. The average expectation of life of the needle-polishers at Sheffield is only 30.66 years. In this work, and that of grinding knives, scissors, and similar articles, metallic and mineral dust are combined, the latter consisting of particles of silica from the grindstone. The mineral dust inhaled in the grinding-shops of glass-works produces very grave diseases. According to Hirt, the average duration of life in grinders who have adopted this work after having reached the age of 25, is 42.50 years, while in those who began the work at the age of 15 the average life is only 30 years.

Stone-cutters in Germany live 36.3 years, according to Hirt. The Massachusetts table gives for 1,025 deaths an average age of 40.90 years.

The inhalation of tobacco dust does not seem to produce serious diseases, but, according to Dr. R. S. Tracy, the fecundity of workers in tobacco is much below the average. This is probably attributable to the fact that females who work in tobacco abort frequently. Cigar-making ranks as an unhealthy occupation, the average age at death being 38.36 years, according to table II.

Cotton operatives are said to suffer from a peculiar and very fatal form of pneumonia, first described by Coetsem in 1836, and named by him *pneumonie cotonneuse*. I have not been able to find in the literature of the subject any record of other observations of this affection. Rag and wool sorters are liable to a fatal infectious disease, which is probably anthrax, the disease germ adhering to the wool or rags, and being accidentally inoculated upon the hands of those handling these articles.

Millers, according to Hirt, live 45.1 years; according to table II, 57.14 years. Pulmonary affections are frequent among them, 20.3 per cent. of all their diseases being pneumonias, 9.3 per cent. bronchial catarrhs, and 10.9 per. cent. phthisis. The workmen in grain elevators suffer severely from pulmonary catarrhs, due to the irritating dust which they are constantly compelled to inhale.

Brush-makers may only hope to live 43.11 years. Hirt considers it a very dangerous occupation, owing to the multitude of sharp fragments of bristles with which the air is loaded, and which, being inhaled, produce pulmonary diseases. Nearly one half of the deaths among them are from phthisis.

The operatives in match factories suffer severely from the effects of phosphorus. The milder effects of the poison are limited to the production of pulmonary and digestive disorders. But a much more severe disease is sometimes produced. This is a periostitis followed by necrosis, and limited to the lower or upper jaw. Between 11 and 12 per cent. of the employés in match factories suffer from the disease. The average

time after the beginning of the employment before the disease appears is five years.

The employés in quinine manufactories suffer from a troublesome eczema, which attacks about 90 per cent. of those exposed. The affection seems to be due to the local action of vapors given off from the boiling solutions.

Firemen on steamboats are exposed alternately to excessively high and very low temperatures. Wyman has shown, in an excellent paper,[1] how severely these workmen suffer on the Western river steamers. He found that "out of forty firemen taken at random, with no effort to select the unhealthy ones, only ten were found who had not contracted pneumonia or pleurisy, or who had not been affected with hemoptysis during the period in which they had pursued their avocation." This writer has also indicated, in the paper referred to, the measures proper to be adopted in order to remove many of the serious dangers to health which environ these workmen. In addition to pulmonary complaints, rheumatism, heart and kidney diseases are prevalent among this class. One form of weak and irritable heart is so characteristic of firemen that it is known in the literature as the "fireman's heart."

Coming to that class of laborers whose work requires the excessive use of certain organs, we find that brain-workers, as a class, live long.[2] Those professional men whose occupation compels the exercise of high mental power, have a higher expectation of life than any other class except farmers and certain mechanics actively engaged out of doors. Those professional occupations only which necessitate a more or less irregular mode of life and frequent subjection to physical exhaustion and dangers from contagious diseases, such as physicians and journalists are exposed to, make an unfavorable showing in the statistics.

Carvers, book-binders, engravers, shoemakers, book-keepers, and cigar-makers, whose occupations compel them to maintain a constrained attitude, all have a short average duration of life. The classes of diseases from which these artisans suffer are consumption, and various chronic derangements of the digestive organs.

All persons who are exposed by their occupations to the frequent occurrence of accidents, have a short expectation of life. Persons liable to these dangers are machinists, operatives in factories, workmen in powder-mills, baggage-masters, brakemen, drivers, engineers, firemen, and other workmen on railroads. Brakemen on freight railroads are classed by insurance companies as the most hazardous "risks." Our table tends to confirm the conclusions of the insurance companies, for, excluding the class of students, which for manifest reasons cannot be used as a comparison, brakemen have the shortest average duration of life of all the occupations noted in the table.

I am quite ready to admit not only that this paper is incomplete, but

[1] *Annual Report of Supervising Surgeon-General U. S. M. H. Service*, 1876-'77.

[2] In the first volume of the Transactions of this Association will be found an admirably written paper on "The Longevity of Brain-Workers," by the late Dr. George M. Beard.

that it is of very little value as a contribution to our knowledge. The papers read before this association should be the outcome of original investigation, and not the products of bibliographical research. In spite of this, however, I hope it may awaken an interest in the subject, and lead others with more ability to take up the work. I venture to suggest that a special committee be appointed to study the subject practically. Each member of the committee should be expected to contribute the results of his inquiries at the next annual meeting. It gives me pleasure to state that examples of what such investigations should be will be presented to the association at the present meeting by my colleague, Dr. Wyman, and your own townsman, Dr. Homan.

XXII.

THE DISPOSAL OF SEWAGE.

By GEO. E. WARING, Jr., C. E.,
Newport, R. I.

It is not likely that towns situated on great rivers or on the seacoast will, for a long time to come, give thought to any other disposal of their sewage than its discharge directly into the river or into the sea. As the country fills up, and as towns situated on small streams or on no stream increase in size and in wisdom, they must perforce seek for some means to get rid of the copious flow of water made foul by its passage through the houses and shops of the people.

The indications are clear that legislative control of this matter cannot long be delayed; and there is no more intricate or more interesting problem now presented to the sanitarian than the correct solution of this great question of the future. Its final solution implies a better acquaintance with the ultimate theory of organic decomposition, and of filtration, than any one now possesses. It seems, however, as though the scientific world had at last reached the threshold of real knowledge concerning the processes by which organic matter is converted into those mineral compounds, which, inoffensive and innoxious in themselves, become in the economy of life the direct food of growing plants.

It is these processes that we must employ in the successful destruction of all organic waste. They go on in spite of us;—we may delay them, or conceal them, or change the seat of their activity; we may hasten them, or modify them, but we cannot prevent them. Sooner or later, by combustion, by direct putrefaction, or by indirect fermentation, they will work their destructive end, bringing all matter that has once lived again back to the domain of life. The cycle is unceasing, and, according to our action concerning it, or according to our neglect, will its influence be good or bad. Thus far we are not quite sure how our action should be guided. While we await this further intimate knowledge on the subject, we may apply successfully and in the right direction a few general principles concerning the preliminary processes of disposal.

The various methods of "dry conservancy," such as the earth-closet, the ash-closet, and the movable tub, to which much attention has been given and by which some success has been achieved, relate mainly to the disposal of solid fœces, that relatively small portion of our offscourings that is offensive when first produced. They leave practically uncared for the treatment of a large part of the urine, all fouled liquids, and the

very important item of kitchen waste. Without undervaluing the relief that they afford with reference to fœcal matter and its menace of direct infection, it must still be considered that they by no means serve to abate the general nuisance that the life of every community creates.

The coarser garbage, and all that may be included in the somewhat vague term of "swill," we shall probably for a long time, especially in towns of moderate size, be able to turn to some account,—at least to secure its final disposal without direct injury to ourselves or our neighbors. All that comes under the generic head of "sewage," *i. e.*, all of the water which has served its purpose in the household and in the factory, and has been discharged with its burden of refuse organic matter, must be treated separately and completely.

As already intimated, the withdrawal from the liquid outflow of offensive fœcal matter hardly lessens the magnitude of the problem, which may be comprehensively stated thus: *To restore to organic life all organic products which have fulfilled their office in consumption by the community and are rejected as water-carried wastes.*

The substances thus to be restored must not be confounded with the water by which they are borne. So long as they remain in their fresh condition, they may, by filtration, be entirely removed from the liquid, the whole volume of the water being regained in a pure condition. In other words, what we have to dispose of is not the water which carries the wastes, only the wastes themselves. The water is a mere vehicle, which, having performed its duty of transportation, needs only to be discharged of its burden, while the burden itself must be as completely destroyed as it would be by burning in a furnace. While the water is theoretically only a means of conveyance, it is practically an encumbrance—greater or less according to its quantity—and our first care should be so to arrange our appliances for removal that its volume shall be as little as is consistent with a complete performance of the work. Practically, while the water in itself is not objectionable, it constitutes, when mixed with waste matters, the most serious element with which we have to deal. Could the refuse matters be completely separated and treated by themselves, there are many simple ways in which they might be made not only inoffensive, but positively useful. The fact that they cannot be economically separated by any process yet devised, and made available for commercial treatment, is the cardinal fact on which the difficulty of sewage disposal depends. Therefore the first care should be given to a control of the volume of water to be used.

While this must be sufficiently copious to secure the complete removal of all that portion of our waste that is delivered into drains, and sufficiently copious to maintain the drains themselves in a cleanly condition, it must not be unnecessarily increased and thus made the source of added trouble in the ultimate process of purification. Whatever method of final disposal may be adopted, whether by irrigation, by artificial filtration, or by chemical combination, its volume should be uniform. It should be practically the same day after day. This implies the complete

exclusion from the sewage of the varying intermittent added volumes due to rain-storms.

Without entering at all into the general discussion as to the advantages or disadvantages of the separate system of sewerage, it will be assumed, for the purposes of the present paper, that the entire water-borne waste of the community contains only so much water as is necessary to fulfil the above-named conditions, and that the daily volume of discharge is substantially uniform.

The question now arises, What shall be done with this uniform volume of fouled water? Not to complicate this question by considering what under special circumstances may be, but what generally is not, necessary—chemical treatment—we may with advantage confine our attention to filtration and irrigation, which latter may or may not be a process of filtration, and to purifying processes active in foul water itself when exposed to the air.

One of the simplest forms of artificial filtration is that recommended by Mr. Croes in his project for the sewerage of East Orange, N. J., being the use of the Oldham-Farquhar filter, with sawdust as the filtering medium. This probably would not leave the escaping water sufficiently pure for domestic use, but it is assumed that it would make it fit for introduction into any water-course from which a domestic water supply is not immediately taken. The sawdust acts as a strainer and clarifier rather than as a completely purifying filter. By the use of an ingenious mechanical contrivance, the mass is prevented from becoming too much compacted and clogged, and the upper portion, containing all of the coarser matters, is from time to time removed for partial desiccation and destruction by fire. Wherever land is not available for irrigation, this may be a satisfactory process. Its use, however, is not likely to become general, nor to be adopted by towns which can even with considerable cost and inconvenience obtain suitable land for irrigation. Indeed, it seems hardly extravagant, in view of the experience already obtained, to assume that some form of application to the soil is to be almost universally adopted in artificial purification.

The degree to which the purification of sewage by application to the soil is to be regarded as filtration depends entirely on the relation between the volume of sewage and the area of land. Where the area is very great, and the amount of sewage is only such as may be absorbed by the surface-soil and retained until given off by evaporation, there is no filtration; where the volume of sewage is very great and the area of the land restricted, *i. e.*, where the amount of liquid applied to the land is greater than it, and the crops growing upon it, can discharge by evaporation, then the surplus descends by filtration to the sub-soil, to be removed by natural or artificial underdrainage. The amount that may be removed by evaporation, especially while vegetation is active, is much greater than would be supposed. In experiments made on a large scale in connection with the irrigation works of Paris, at Gennevilliers, Marie-Davy found that of 24,000 cubic metres of sewage delivered upon a hectare of

land in six months, only 1,600 reached the tight bottom of the tank, six feet below the surface, to flow off through the underdrains. In winter the evaporation would be much less, and during extreme cold weather still less. At the same time, under all circumstances, it is an important factor to be considered.

Whether the water descends slowly, leaving its impurities attached to the soil and flowing off pure, or whether it is discharged into the atmosphere by evaporation from the surface, leaving its impurities in like manner, the principle is the same. In one way or the other the water is got rid of in a pure condition, and the impurities it has carried are deposited on the surfaces of the particles of the soil. Thus far the waste matters have been removed from the water,—they have not yet been "got rid of."

Precisely what change they undergo, and in what way, is not fully determined, but we are justified by investigations already made in accepting a theory which accounts for the remarkable results with which we are familiar, and which is in accordance with such knowledge as we now possess. The engineers, chemists, and biologists who have made a study of the works at Gennevilliers show good reason for their belief that the organic matter thus deposited becomes food for the bacteria of putrefaction, which are abundant in all soils containing organic matter, and to which the air has free access. They believe that in a porous soil, suitably constituted and containing the impurities of town sewage, these bacteria multiply enormously, consuming the pabulum presented to them, combining with it the oxygen of the air with which the soil is pervaded, and reducing it entirely to such inorganic compounds as constitute the food of plants, available for the uses of vegetation during the proper season, and readily removed in solution by the water percolating through the ground at all times. The complete destruction of these wastes, as organic matter, is effected before they are taken up by plants, and before they can be removed from their contact with the soil by the water descending through it.

The water of the deep underdrains of ground heavily irrigated with sewage often contains nitrates and the salts of ammonia. It does not contain organic matter as such. The same salts constitute the food of growing plants, which organic matter, as such, does not.

When we have reduced the filth of our sewage to the condition in which it may be washed out of the soil, or absorbed by roots, then, and not till then, have we destroyed it as filth.

The great advantage that the soil possesses as the seat of putrefaction lies in the minute division of the material and the universal distribution of oxygen to aid in its destruction, in detail and completely. If the liquid wastes of the kitchen and laundry, and of the chamber, delivered before putrefaction into the aerated spaces of a porous soil, will have their organic matter destroyed in the way described, without the production of offensive exhalations, and, as is believed, without the possibility of danger to health, the same liquids delivered into a cask and left to putrefy would in time undergo the same complete destruction of their organic

parts, but the putrefactive process, carried on with a much less complete exposure to the air, would be of an offensive character. The water would in time become pure, but only as its various portions, by slow process, came into contact with the air near the surface. The withholding of oxygen from the interior of the mass would lead to other forms of decomposition of which the exhalations are offensive and the influence probably dangerous to health.

The same principle holds as between surface irrigation and deep cesspools. A discharge at or near the surface is a discharge into well aerated ground. The leaching from cesspools is much further from the surface and into ground where free access of atmospheric oxygen is impracticable. In the one case we have a safe result, and in the other an extremely unsafe one.

The degree to which water may be relieved of its offensive accompaniment by irrigation processes is very remarkably shown by the investigations made at Gennevilliers, described by Dr. Proust in his report to the Technical Commission on the Sanitary Improvement of Paris, December 2, 1882. He gives an account of microscopic examinations made by Marie-Davy and Miquel, with a careful enumeration of the microbes or living particles found in a cubic centimeter of various waters. The result was as follows:

Sewage at the outlet of the Main sewer of Paris contained per cubic centimeter	20,000	microbes.
The water of the Seine contained	1,200	"
The water of the Vanne[1] contained	62	"
Rain water contained	35	"
The underdrainage of Gennevilliers contained	13 to 24	"

This last water was also free from putrescible matter.

Various difficulties present themselves when the facilities for irrigation disposal are considered in connection with any particular place. It is sometimes the quality of the soil, sometimes its defective drainage, sometimes its high elevation with reference to the town, or its low elevation with reference to an adjoining water-course. These conditions may materially modify the method to be adopted, as may the area of the land available. But, in one way or another, these difficulties may usually be overcome, and the town may be given facilities for the purification by the soil of all its foul sewage. Generally, the process is relatively inexpensive, and under proper conditions may be made remunerative. The vital point is now fully secured: absolute purification is within our reach, wherever this system is practicable.

The limits of this paper will not permit a discussion of the various methods and conditions of practical sewage irrigation. As a rule, it may be said that the greater the available area of the land to be irrigated, the better the chance of a profitable result; the greater the volume of sew-

[1]The drinking-water of Paris.

age to be delivered at a time, the more even the distribution over a wide surface; and the more immediately the delivery after production in the houses, the less the liability to offensive exhalation. Indeed, if the sewage of a single day or of a half day could be discharged in a rapid flow over as much land as its volume would enable it to reach, and if nothing were retained in the collecting chamber, in the pipes and sewers, or in the traps of water-closets, sinks, etc., in the houses, long enough for putrefaction to commence, the whole operation would be practically odorless.

As already stated, it is essential that the discharge should be intermittent. If only one area of ground is used, the flow should be held back to be discharged not oftener than once a day. If the irrigation fields can be divided into two or three different areas, each capable of receiving the full flow, each should lie idle two days after each single day's use. Where the discharge is constant, the flow should be delivered alternately over three or more different areas,—better at intervals of not less than two days.

At times it becomes necessary—more often in connection with one or a few houses than with a town—to dispose of sewage otherwise than by *surface* irrigation. In such case a perfect result may be obtained by the use of the system of sub-surface irrigation, where the liquid is distributed through open-jointed drains laid a few inches below the surface of a suitable soil. The discharge being intermittent, a sufficient time between consecutive discharges must be allowed for the oxidation of the material retained by the soil to become well established.

The most natural objection raised when irrigation disposal is proposed for Northern towns is the severity of our Northern winters. This constitutes no obstacle in any place with which I am familiar, whether for surface irrigation or for the open pipes of the sub-surface system. Ample experience in New England, and even on the coast of the Baltic sea at Dantzic, shows that the severest winter offers no cause for interruption to the perfect working of either.

There are low lying outlets whose flow cannot be spread over deeply drained land without artificial pumping, and artificial pumping is a huge bugbear to the ordinary town economist. In such cases use may be made of the purifying processes always at work in water flowing in shallow channels. The minor organisms—animal and vegetable—which abound in water containing organic impurities, act on the food offered them by such impurities very much as do the bacteria in the soil on what is there in like manner offered to them. Thus, without question, may towns which are so unfortunately situated as not to be able to resort to irrigation, find a satisfactory means of relief. In such cases the growth of willows or of rushes may be made an efficient aid to purification and a source of no inconsiderable income.

Another consideration should not be lost sight of: When *fresh* sewage is discharged into a water-course, most of its organic matter is consumed by fishes, as on land it would be consumed by poultry and swine. Sewage delivered in a putrid condition would, on the contrary, drive all fishes from the polluted part of the stream.

XXIII.

THE RELATION BETWEEN UNDERGROUND SEWERAGE AND FILTH DISEASES.

By S. S. HERRICK, M.D.,

SECRETARY BOARD OF HEALTH, STATE OF LOUISIANA.

The accompanying statement has been prepared from data kindly furnished by medical men (chiefly health officers) in the various cities named, and has been delayed one year on account of prolonged illness. It was hoped that the investigation would throw clear light upon the question indicated by the title, but this having obviously failed, it only remains to elicit from the figures such instruction as they may afford on other points.

The difficulties besetting this research are greater than would appear to the casual inquirer. In the first place, he who would estimate the effect of a given cause upon the public health should know the whole number of cases of disease which are chargeable to it; but we get a record of the fatal cases only. Of the diarrhœal diseases generally, a vast majority of the cases recover, and an actual majority of typhoid fever and diphtheria; and the severity of all classes varies greatly in different seasons. Again: Diagnosis is a very uncertain element in the calculation, being largely dependent on the "personal equation" of the medical attendant. Each "personal equation" would be a severe study to an intimate acquaintance, and a thousand of them to a stranger would be a hopeless task. At the best, therefore, only a distant approach to a correct result could be hoped in a given locality; but the chances are somewhat improved when we can group a considerable number together, with the prospect that errors may, to an uncertain extent, correct each other. It was in this view that averages of single years and of three years together have been made in the table, by gathering the cities in groups of ten, nineteen, and nine, according to the extent of their sewerage system.

To review the consolidation, the first group embraces those cities in which the sewerage system includes the population, varying from three fourths up to the whole; the second group has an enjoyment of sewerage varying from one twentieth of the population to two thirds inclusive; the third has no sewerage at all. Designating them as 1, 2, and 3, and observing that the mortality is calculated as so many per one thousand, according to the census of 1880, we find the following for the three years 1880, 1881, and 1882, taken together:

Typhoid fever, (1), .51; (2); .73; (3), .77.
Diphtheria, (1), .95; (2), .98; (3), .58.
Diarrhœal diseases, (1), 2.67; (2), 1.93; (3), 2.48.

The apparent conclusion from these figures is as follows: 1. Sewerage is favorable as regards typhoid fever. 2. As regards diphtheria, sewerage, complete or partial in any degree, is about alike, but each much more unfavorable than none at all. 3. As regards diarrhœal diseases, the best condition is partial sewerage; complete sewerage and none at all being nearly alike in effect.

In the writer's opinion, a reasonable conclusion would be, that underground sewerage is not an important factor either in the causation or the prevention of filth diseases. With regard to typhoid fever and diphtheria, acknowledged as infectious, suitable methods of disinfection are admittedly so necessary and so effective as to render sewerage indifferent; and the same might be said of the diarrhœal diseases, so far as their infectious character goes.

These inferences are drawn from figures in connection with sewerage systems as actually administered; but doubtless improvements might be made which would give better results. Evidence on this point is furnished by the new, nearly complete, and separate system of Memphis, where the sewage-pipes are small, and are washed out twice daily; and where we find a mortality from typhoid fever and diphtheria lower than the average in sewered cities, along with a remarkably high rate from diarrhœal diseases. But, on any plan, new works would show more favorably than the same would after joints and connections have begun to loosen and filth become permanently adherent to interior surfaces. The only security from the reflux of sewer gases into inhabited apartments lies in frequent and skilled inspection, such as no ordinary health organization could afford to maintain, and the average landlord would never give to his tenants. Therefore, while theoretically a decided advantage might be conceded to underground sewerage, we can easily account for practical results as we find them. Besides, other methods of disposing of fæcal matters are susceptible of great improvement, attainable with a supervison requiring less skill and intelligence than that demanded by a complex sewerage system.

Therefore, the conclusion of the whole matter would be, that the advantages of underground sewerage lie in a questionable economy and an undisputed convenience and decency in removing filth from urban habitations, without decided sanitary significance.

TABLE to illustrate the Relation of Underground Sewerage to Filth Diseases.

Name of City.	Is the city sewered?	What part of the population lives in the sewered portion?	Are sewage and storm waters conveyed together or separately?	Is there any arrangement for flushing the sewers?	How are they ventilated?	Rate per 1000 of population of Mortality from Filth Diseases. Typhoid fever. 1880.	1881.	1882.	Diphtheria. 1880.	1881.	1882.	Diarrhœal diseases. 1880.	1881.	1882.
Erie, Pa., . . .	Completely.	The whole.	Together.	Yes.	By man-holes with perforated covers.	.43	.86	.72	1.33	1.80	1.48	.93	3.14	1.48
New York, N. Y., .	Yes.	95-100.	Together.	None except by storms.	Perforated man-hole covers; rain-water and waste-pipes in some cases.	.20	.37	.30	1.15	1.86	1.26	3.27	3.54	3.35
Cambridge, Mass.,	Yes.	Nearly all.	Together.	Gates and flushing man-holes.	Perforated man-hole covers in last two years.	.15	.41	.32	.72	1.50	.93	1.80	2.31	1.55
St. Louis, Mo., . .	Yes.	9-10.	Together.	By fire-plugs.	Through house-drain ventilators above roofs of buildings.	.39	.54	.47	.32	.44	1.09	1.85	2.51	2.00
Augusta, Ga., . .	No general system.	About 5-6.	Together.	Imperfect.	. . . . . .	.73	1.96	.68	.55	.41	.55	4.29	7.71	5.20
Somerville, Mass.,	Yes.	About 7/8.	Together.	Partial.	Open man-hole cov'rs for a portion.	.28	.32	.32	.76	1.76	2.08	2.36	2.08	1.44
Boston, Mass., . .	Yes.	About 4-5.	Together.	No.	Open man-hole covers in the sts.	.33	.57	.58	1.08	1.65	1.26	1.91	2.18	2.38
Jersey City, N. J., .	Yes.	About 3/4.	Together.	Yes.	By man-holes.	.26	.73	.65	.48	.71	.74	2.17	2.58	2.58
Memphis, Tenn., .	Yes.	About 3/4.	Separately.	Autom't'c flush-tanks twice in 24 hours.	4-inch ventilators for all house connections.	.50	.50	.32	.15	1.10	.26	3.12	4.88	2.97
Concord, N. H., .	Yes.	About 3/4.	Together.	None specially.	By catch-basins and soil-pipes.	. .	.43	.57	. .	.29	.14	. .	1.64	.57
Washington, D. C.,	Yes.	About 2/3.	Together.	By fire plugs.	By perforated covers on man-holes.	.57	.45	.81	.19	.84	.78	1.64	3.10	2.17
Brooklyn, N. Y., .	Yes.	About 2/3.	Together.	By storm-water and hose.	Partially by perforated man-hole covers.	.12	.17	.16	1.97	2.06	1.11	2.84	3.01	3.34
Chicago, Ill., . .	Yes.	About 2/3.	Together.	Yes.	By perforated iron covers.	.34	1.12	.91	1.84	1.20	1.03	1.80	3.03	2.37
Toledo, Ohio, . .	Yes.	About 2/3.	Together.	By water-works.	Not at all.	.16	.42	.30	.24	.56	.76	1.16	1.90	1.16
Lawrence, Mass., .	Yes.	About 1/2.	Together.	None.	By man-holes.	. .	. .	.74	. .	. .	.82	. .	. .	3.10
Indianapolis, Ind.,	Yes.	About 1/2.	Together.	None.	By man-holes.	.80	1.14	1.48	.08	.46	.24	.36	.44	.40
New Haven, Conn.,	Yes.	About 1/2.	Together.	None.	No system.	.24	.44	.38	1.16	.93	.95	1.06	1.16	1.62

Newark, N. J., . .	Yes.	About ½.	Together.	. . . .	By man-holes.	.30	.53	.39	.79	1.13	.92	.25	.34	.28
Ogdensburg, N. Y.,	Yes.	About ½.	Together.	Yes.	By man-holes.	No	r'c'd	.48	No	r'c'd	.96	No	r'c'd	1.65
Cleveland, Ohio, .	Yes.	About ½.	Together.	Yes, in summer.	Not heretofore; by perforated man-hole covers hereafter.	.43	1.05	.76	1.29	1.22	1.31	2.00	3.70	2.67
Lynchburg, Va., .	Yes.	About ½.	Together.	None.	Partly by sewer inlets; partly by house connections.	.56	.81	1.31	.18	.36	.24	.72	2.64	2.37
Taunton, Mass., .	Partially.	Small portion.	Together.	By hydrants.	. . . .	.42	.61	.99	.70	.99	.28	1.51	2.12	2.17
Davenport, Iowa, .	Partially.	About ⅓.	Together.	By hose in man-holes.	By man-holes in every square.	. .	.55	.32	. .	1.01	.59	. .	3.30	1.14
Grand Rapids, Mich.,	Partially.	About ⅓.	Mostly together.	By hydrants.	By perforated man-hole covers.	.75	1.40	.53	3.78	3.78	2.31	1.56	3.75	2.71
Rock Island, Ill., .	Partially.	About ⅓.	Together.	By hose to hydrants.	By perforated man-hole covers.	. .	1.20	.94	. .	.51	.86	. .	1.81	.94
Atlanta, Ga., . .	Partially: not systematically.	Unknown.	Together.	By hydrants.	By openings at surface drains.	.66	1.81	1.41	.13	.05	.21	3.04	5.48	4.89
Richmond, Ind., .	Partially.	About ¼.	Together.	None.	Practically not.	.23	.63	1.02	.40	.23	.92	1.02	1.15	.80
Pittsburgh, Pa., .	Partially.	About ¼.	Together.	None.	Imperfectly by man-holes.	1.34	1.56	1.71	1.98	1.34	1.18	1.68	2.58	2.39
Lansing, Mich., .	Partially.	Abo't 1-20.	Separately.	None.	Perforated man-hole covers.	1.08	.84	.24	1.56	.24	.60	.96	.96	1.08
Newburyport, Mass.,	No.	. . . .	. . . .	. . . .	. . . .	.44	.37	.59	.22	.37	.22	1.48	1.76	2.20
Rome, N. Y., . .	No.	. . . .	. . . .	. . . .	. . . .	No	r'c'd	.57	No	r'c'd	.49	No	r'c'd	3.44
Waterbury, Conn.,	No.	. . . .	. . . .	. . . .	. . . .	.28	.45	. .	.17	.22	. .	1.12	1.56	. .
Flint, Mich., . .	No.	. . . .	. . . .	. . . .	. . . .	N	on	e	.012	.024	N'e	1.17	.94	.70
Salt Lake, Utah, .	No.	. . . .	. . . .	. . . .	. . . .	.53	1.54	1.25	5.36	2.27	.57	1.88	4.05	2.60
Knoxville, Tenn., .	No.	. . . .	. . . .	. . . .	. . . .	.72	1.23	2.68	.31	.20	1.13	1.65	2.16	1.44
Charleston, S. C., .	No.	. . . .	. . . .	. . . .	. . . .	1.12	1.14	1.06	.18	.50	.48	2.76	3.70	2.58
Baton Rouge, La.,	No.	. . . .	. . . .	. . . .	. . . .	.85	.85	1.90	N	on	e	2.71	7.57	6.14
New Orleans, La.,	No.	. . . .	. . . .	. . . .	. . . .	.25	.31	.36	.39	.28	.20	1.51	2.68	1.84
Averages of the first ten cities,						.36	.67	.49	.73	1.15	.97	2.41	3.25	2.35
Averages of the nineteen next cities,						.53	.87	.78	1.09	1.00	.85	1.44	2.38	1.96
Averages of the last nine cities,						.52	.74	1.05	.84	.51	.39	1.78	3.05	2.62
Averages of the first ten cities for the three years,							.51			.95			2.67	
Averages of the nineteen cities for the three years,							.73			.98			1.93	
Averages of the last nine cities for the three years,							.77			.58			2.48	

XXIV.

THE RELATION OF THE DEPTH OF WATER IN WELLS TO THE CAUSATION OF TYPHOID FEVER.

By HENRY B. BAKER, M. D.,
Lansing, Mich.

During the last six months of the year 1881, and the first three months of 1882, sickness from typhoid fever was, I believe, much more than usually prevalent in the state of Michigan. The evidences of the truth of this statement are found in the annual reports of the Michigan State Board of Health; and they consist of replies by regular correspondents to questions asked by the board,[1] and of tables compiled from weekly reports of sickness made by health officers and other prominent physicians in different parts of the state.[2] Of forty-three correspondents, eleven reported typhoid fever (and nine reported typho-malarial fever) unusually prevalent in 1881, while only one reported typho-malarial fever and not one reported typhoid fever as less than usually prevalent in that year.

TABLE I.

By year and months for each of the six years 1878–1883, *and on an average for the five years* 1878–1882, *stating on what per cent. of the weekly reports of diseases received Typhoid Fever was reported present.*

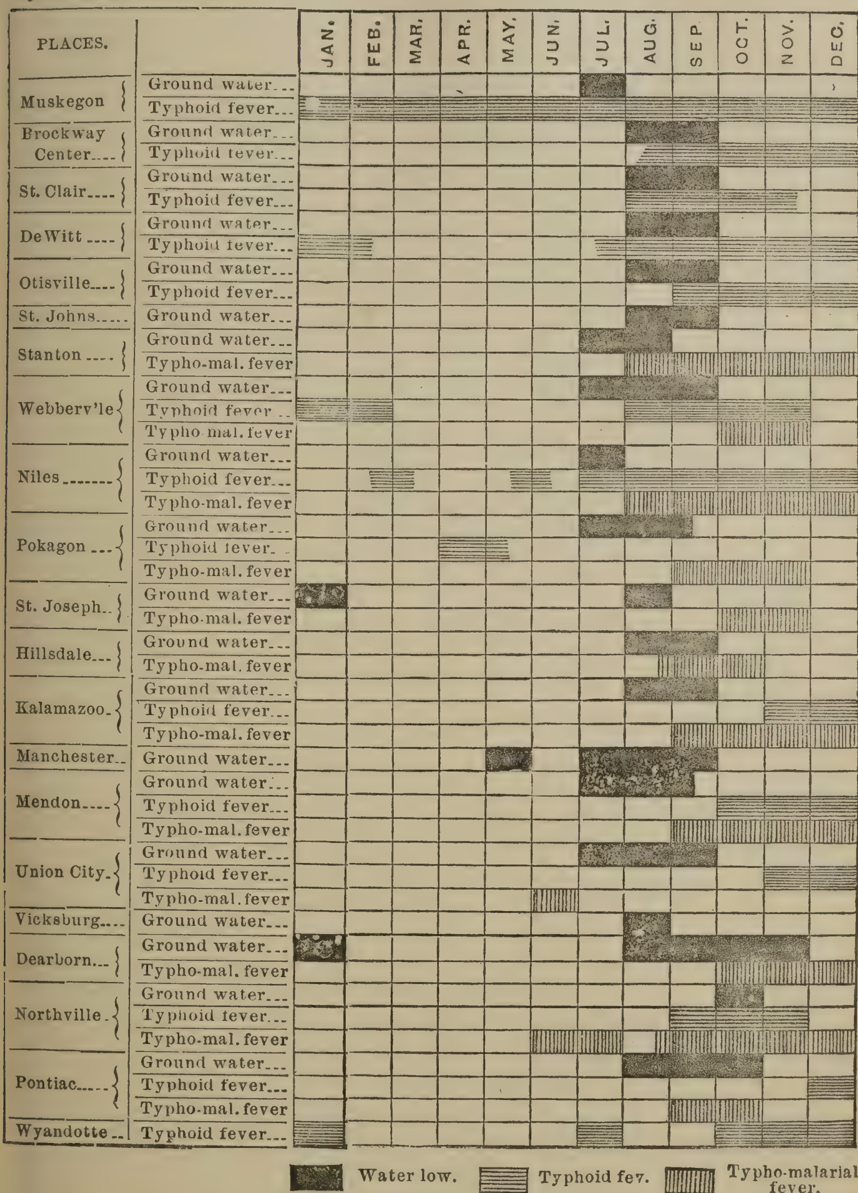
YEARS.	Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Average five years, 1878–1882	13	12	11	8	6	6	6	8	15	22	25	23	17
1878	10	12	9	7	4	7	6	6	10	13	18	11	12
1879	12	6	..	6	8	3	4	5	14	20	24	25	17
1880	14	8	13	7	5	6	5	10	19	26	23	22	17
1881	18	13	10	7	5	6	6	12	23	35	37	32	25
1882	14	21	16	12	8	7	9	8	11	17	23	23	16
1883	11	11	7	7	7	6	7	6	11	19	21	17	14

By the table (No. 1) which is here submitted, it may be seen that, beginning with July, 1881, the sickness reported from typhoid fever was about fifty per cent. greater than the average for corresponding months in the five years 1878–1882, and it continued at this high rate until April, 1882.

[1] Pp. 285–289, Report of Michigan State Board of Health, 1882.

[2] P. 568, Report for 1882, and p. 241, Report for 1883.

DIAGRAMATIC TABLE No. 2.—*Exhibiting Correspondence in Time and Place Between unusually Low Water in Wells and the Occurrence of Typhoid Fever, in Michigan in 1881. Data obtained from Replies by Correspondents and from Weekly Reports of Diseases.*



For this increased prevalence of typhoid fever, various supposed causes were alleged by the physicians who reported; but taken altogether the alleged causes seem at first sight nearly to negative each other, the number alleging excessive rain-fall, wet soil, etc., at some time during the year, about equalling the number who alleged unusual drouth as the cause of the sickness. But by a careful study of the evidence relative to the condition of the soil and of the ground-water, immediately preceding and during the prevalence of sickness from typhoid fever, it is found that it was one of unusual drouth and low water in wells in quite a number of different parts of the state, beginning with July, 1881, and that although the rain-fall later in the year was sufficient to make the surface-soil moist, the water in wells continued unusually low. It was especially low in July, August, and September, 1881. From reports by meteorological observers for the Michigan State Board of Health for the summer and autumn months in 1881, I quote as follows:

Dr. J. S. Caulkins, M. D., of Thornville, says,—"July has been a very hot and dry month. * * * Crops are badly injured by the drouth. August has been a dry, hot month. Vegetation has suffered beyond all record. At a short distance a pasture cannot be told from ploughed field. * * * The crops are almost a total failure." Dr. James S. Reeves says,—"The driest ever known here." For October, Dr. Caulkins says,—"In spite of the heavy rain-fall, water has not risen in the wells and springs, and below the wet there is a stratum of dry earth one or two feet in thickness." At the close of the year, Dr. Caulkins reports: "December has been a warm, open month, with scarcely any snow, and very bad roads. There is no frost in the ground worth speaking of as the month closes; no ice in the lakes and streams. Water is still low in spite of all the rains we have had."[1]

I submit herewith a diagramatic table (No. 2), in which is summarized the evidence which seems pertinent that was contained in replies by regular correspondents of the Michigan board of health, relative to the months in the year 1881 in which the ground-water, as observed in wells, etc., was unusually low, and the months in that year in which typhoid fever occurred under their observation. It may be seen that in quite a number of localities observers have made records which show either a coincidence between the low water and sickness from typhoid fever, or that the fever occurred in months succeeding the low water.

I have shown that the sickness from typhoid fever in Michigan was unusually great in the last part of the year 1881 and first part of 1882, compared with other years, according to reports extending back to 1876. I submit herewith a table (No. 3), showing that the deaths from typhoid fever were also unusually numerous in the year 1881, compared with other years. The mortality statistics extend back to the year 1866.

I have compared reports of the meteorological and other conditions in

[1] Dr. N. S. Davis reports a very dry summer in 1881, with an exceptionally high typhoid death-rate in Chicago (*Chicago Med. Jour. and Examiner*, February, 1882, vol. 44, pp. 113–117); and a very destructive drouth appears to have prevailed during the summer of 1881, over a large portion of the eastern United States (H. H. Clayton, Jr., in *Am. Meteorological Journal*, August, 1884).

TABLE 3.—*Deaths Returned as having occurred from Typhoid Fever in Michigan, in each of the 16 Years 1867–1882, by Sex and by Months.*

Sex.	Months and Year.														Years.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Unknown Month.	Year.	
Total, . .	36	28	24	22	9	13	19	21	42	60	48	37	2	361	1867
Males, . .	21	16	13	11	3	7	9	13	22	28	24	18	1	186	
Females, .	15	12	11	11	6	6	10	8	20	32	24	19	1	175	
Total, . .	36	28	24	17	14	11	18	45	72	84	31	49	1	430	1868
Males, . .	21	16	13	8	8	7	6	27	37	43	15	29	. .	230	
Females, .	15	12	11	9	6	4	12	18	35	41	16	20	1	200	
Total, . .	17	18	31	18	27	16	21	51	76	79	45	38	. .	437	1869
Males, . .	8	10	19	11	16	8	10	25	36	40	25	20	. .	228	
Females, .	9	8	12	7	11	8	11	26	40	39	20	18	. .	209	
Total, . .	10	17	33	12	17	17	34	64	106	117	94	52	1	574	1870
Males, . .	7	11	9	6	7	6	18	32	50	59	38	27	. .	270	
Females, .	3	6	24	6	10	11	16	32	56	58	56	25	1	304	
Total, . .	16	26	25	23	25	21	15	37	59	41	34	32	3	357	1871
Males, . .	8	15	8	9	13	8	9	18	37	25	23	17	2	192	
Females, .	8	11	17	14	12	13	6	19	22	16	11	15	1	165	
Total, . .	15	25	26	40	25	24	14	39	106	129	97	78	2	620	1872
Males, . .	6	12	13	22	15	15	7	22	59	75	54	39	1	340	
Females, .	9	13	13	18	10	9	7	17	47	54	43	39	1	280	
Total, . .	39	45	32	39	22	24	36	62	103	144	77	50	4	677	1873
Males, . .	23	22	17	24	12	14	16	37	56	83	45	34	2	385	
Females, .	16	23	15	15	10	10	20	25	47	61	32	16	2	292	
Total, . .	33	23	22	24	31	24	30	50	104	123	92	51	3	610	1874
Males, . .	12	16	12	16	13	12	13	26	59	62	46	30	. .	317	
Females, .	21	7	10	8	18	12	17	24	45	61	46	21	3	293	
Total, . .	30	16	21	23	17	22	22	29	55	92	63	40	3	433	1875
Males, . .	12	10	9	16	8	15	12	15	31	50	32	22	. .	232	
Females, .	18	6	12	7	9	7	10	14	24	42	31	18	3	201	
Total, . .	18	18	19	20	17	19	29	54	82	66	49	34	1	426	1876
Males, . .	8	10	11	13	8	11	13	33	34	42	29	21	. .	233	
Females, .	10	8	8	7	9	8	16	21	48	24	20	13	1	193	
Total, . .	14	13	25	18	24	9	18	54	83	85	58	43	2	446	1877
Males, . .	8	5	10	11	11	5	11	29	44	44	32	22	2	234	
Females, .	6	8	15	7	13	4	7	25	39	41	26	21	. .	212	
Total, . .	11	13	16	14	21	13	21	42	54	52	41	31	. .	329	1878
Males, . .	3	10	7	7	14	9	9	22	28	25	25	17	. .	176	
Females, .	8	3	9	7	7	4	12	20	26	27	16	14	. .	153	
Total, . .	15	24	24	23	13	11	18	48	53	61	55	52	. .	397	1879
Males, . .	7	11	14	10	7	3	10	25	26	26	27	24	. .	190	
Females, .	8	14	10	13	6	8	8	23	27	35	28	28	. .	207	
Total, . .	22	13	22	28	20	19	35	73	92	87	58	44	. .	513	1880
Males, . .	9	6	10	17	13	11	23	38	58	43	31	26	. .	285	
Females, .	13	7	12	11	7	8	12	35	34	44	27	18	. .	228	
Total, . .	20	15	23	34	27	35	45	99	150	178	149	108	1	884	1881
Males, . .	13	9	14	21	14	23	26	49	79	83	93	67	. .	491	
Females, .	7	6	9	13	13	12	19	50	71	95	56	41	1	393	
Total, . .	31	34	30	18	35	30	20	*27	52	91	53	40	2	463	1882
Males, . .	19	20	17	11	19	15	9	13	26	54	36	28	2	269	
Females, .	12	14	13	7	16	15	11	13	26	37	17	12	. .	193	
Total, . .	363	356	397	373	344	308	395	795	1,289	1,489	1,044	779	25	7,957	1867 to 1882†
Males, . .	185	199	196	213	181	169	201	424	682	782	575	441	10	4,258	
Females, .	178	157	201	160	163	139	194	370	607	707	469	338	15	3,698	
Total, . .	99	99	115	117	116	108	139	289	401	469	356	275	3	2,586	1878 to 1882†
Average, .	20	20	23	25	23	22	28	58	80	94	71	55	. .	517	

* Includes one "unknown sex." † Inclusive.

the years 1881 and 1882 with those for other years; and I find no condition, concerning which we have records, that varied in such manner as to explain the unusual prevalence of typhoid fever in those months, except the condition of the ground-water, as indicated by the lowness of water in wells. The temperature of the atmosphere was unusually high during those months, but to high temperature of the atmosphere the causation of typhoid fever has never been directly traced. The disease occurs in cold as well as in hot climates, and in cold as well as in hot seasons of the year; and although in Michigan it follows the hot weather of summer, in some other countries it follows the cold season. On the other hand, the disease has many times (hundreds of times, I suppose) been traced directly to the use of contaminated drinking-water.

There is one other closely related physical condition that it would seem may have influence in the causation of typhoid fever, namely, the temperature of water in wells and of the fluids in privies. The temperature of water in wells is recorded and reported each month from some localities in Michigan, and some study has been given that subject in the preparation of this paper; but the changes in the temperature are so slight that it is difficult to see how they can have great influence. Moreover, any effect this may have is so hidden in the greater changes in the quantities of water in wells, usually coincident with if not one cause of the changes of temperature therein, that it is difficult to distinguish separate influences, if such there are.

From the foregoing it appears that in Michigan there is a relation beween low water in wells and the prevalence of typhoid fever; that this relation is found to hold by seasons of the year,—those months in which the water is lowest (or the months immediately following) being the months in which typhoid fever is most prevalent; and the unusual year 1881–1882, when typhoid fever was more prevalent than ever known before, was also unusual because of the exceedingly low water in wells.

A relation of low water in wells to the prevalence of typhoid fever being considered established, several questions arise:—

1. Is there a quantitative relation? That is to say, Is the amount of sickness from typhoid fever proportional to the amount of water in wells?
2. Does the drinking-water cause the typhoid fever?
3. What constituent of the drinking-water causes the typhoid fever?
4. How can typhoid fever be prevented?
5. What need is there for the prevention of typhoid fever in Michigan?

IS SICKNESS FROM TYPHOID FEVER INVERSELY PROPORTIONAL TO QUANTITY OF WATER IN WELLS?

At first glance it may seem to be impracticable to measure and compare quantitatively such dissimilar things as water in wells and sickness from typhoid fever. Yet whenever we can get the statements of the facts, such comparisons are now not difficult. We have only to construct diagrams on the proper principle, and accurately drawn according to definite scales. It may be well to say here, that the way to do this is to so

plan the diagrams and the scales, by which the two or more things to be compared are to be shown, that the *extremes* of the two or more things to be compared (the highest and the lowest statements in the diagram) shall be the same distance apart,—in which case the greatest range of the statements for each will appear to be the same. In a diagram prepared in accordance with this principle, if there is a fixed and definite quantitative relation between the things compared, it will be apparent; because the greatest ranges of the several things compared being made to coincide, the minor fluctuations will also coincide in the amount of space they occupy on the diagram. This will be true as regards the *amount* of the fluctuation, even though the fluctuations may not exactly coincide in point of *time*,—even though one of them, for instance, be constantly in advance of the other in time.

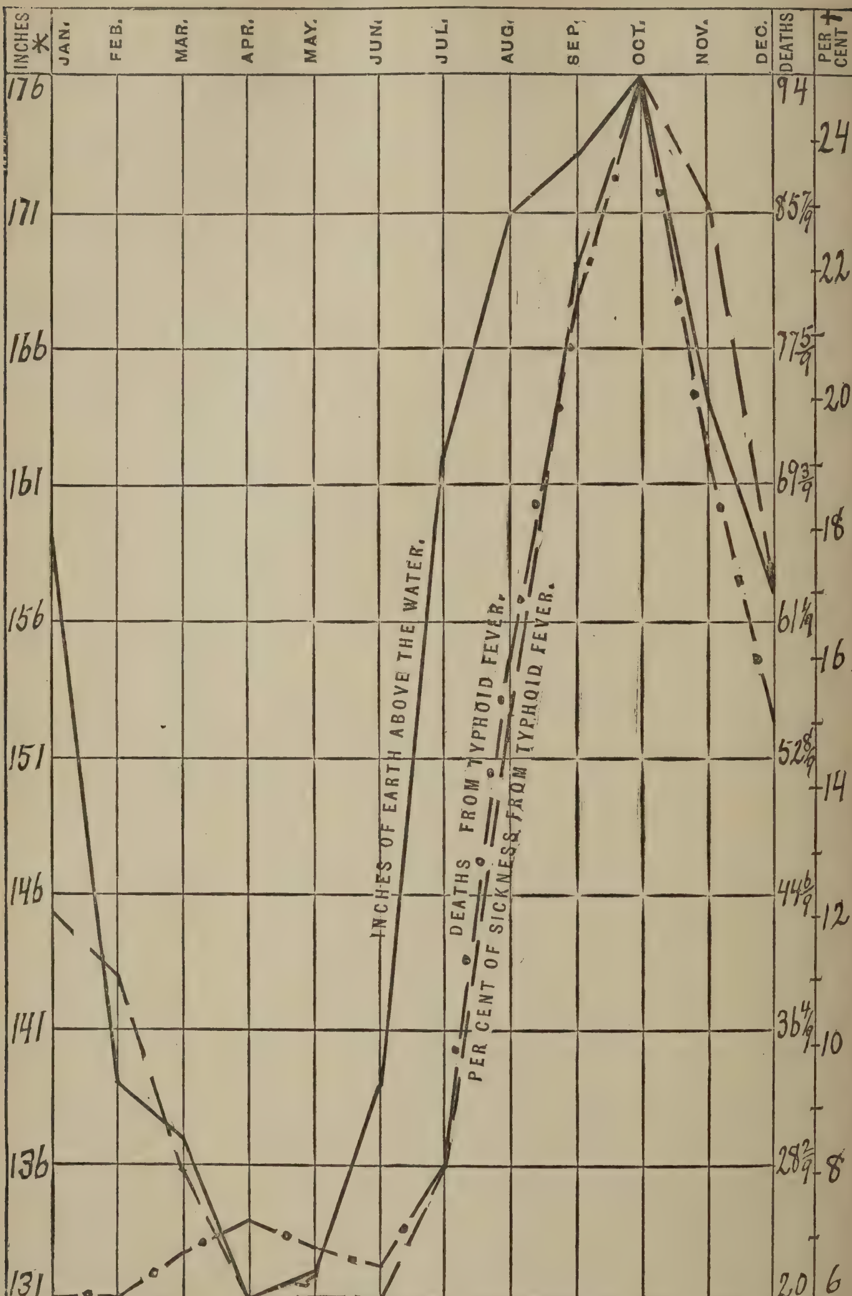
This principle, just stated, has been held in mind in the preparation of the diagrams which I present to you, and which show the relation of the depth of the earth above the ground-water in wells in Michigan, and the prevalence of sickness from typhoid fever in Michigan by months in each of the years 1878, 1879, 1880, 1881, 1882, and 1883, also an average for five years, 1878–1882; this diagram also including statements of the deaths in Michigan from this cause during the same five years. In these diagrams, statements of the "depth of earth" above the water in wells have been employed; because if statements of the "depth of water" in wells were used, the scale would, if upright, have to be the reverse of that used for the statements relative to the sickness, and therefore would not be as easy of comparison. In studying these diagrams, one will need to bear in mind that whenever the "depth of earth" over the water is great, the depth of the water in wells is low, and *vice versa*.

WHAT THE DIAGRAMS SHOW.

In the several diagrams which I present, the statements of the sickness from typhoid fever relate to the state of Michigan as a whole, being summarized from weekly reports of physicians in many parts of the state. The wells measured for these diagrams are not the same in number in both years, and they are not the same wells in both years; so that from the diagrams alone no comparison can be made of one year with the other as to the exact height of the water during the year as a whole, or of one month with the corresponding month in another year. The comparisons intended to be shown are of one month with the others in the *same year*. The number of wells was very few, but an examination of the subject seems to show that it is sufficient fairly to indicate for each year the rise and fall of the ground-water throughout the state. The curves are as nearly alike as one would expect them to be in different years.

From the diagrams it may be seen, that, beginning with June in each year, the sickness from typhoid fever follows, more or less closely, the curve representing the average depth of earth above the ground-water. If the sickness is caused by the low water, there is a good reason why the

DIAGRAM A.—*Exhibiting, for a Period of Five Years (1878–82) the Average Monthly Oscillations of Ground-water in Michigan, the Deaths from Typhoid Fever, and what Per Cent of the Weekly Reports of Sickness Received Stated the Presence of Typhoid Fever.*

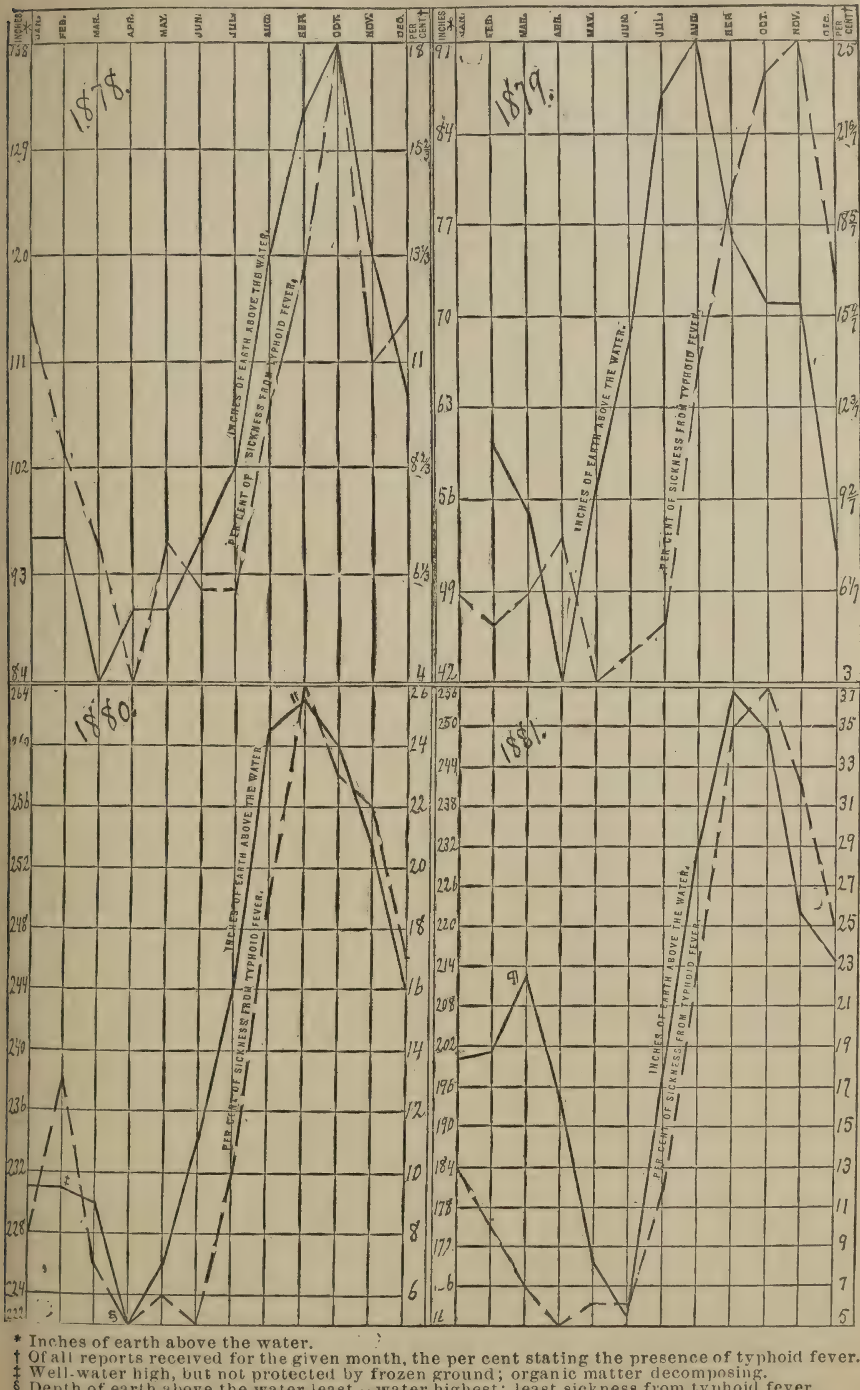


* Inches of earth above water in wells.

† Of all weekly reports received, per cent stating presence of typhoid fever.

NOTE.—The sickness-curve should rise and fall later than the curve for its cause by about the length of the period of incubation plus the average duration of the disease; because the reports of sickness include all cases under observation, old cases and new cases. The time-unit of the diagram is so great (one month) that the interval between the two curves is sometimes greater and sometimes less than the interval between the cause and its consequent sickness.

DIAGRAM B.—*Exhibiting the Rise and Fall of Water in Wells, and of Sickness from Typhoid Fever, in Michigan, in each of the Four Years 1878-81.*

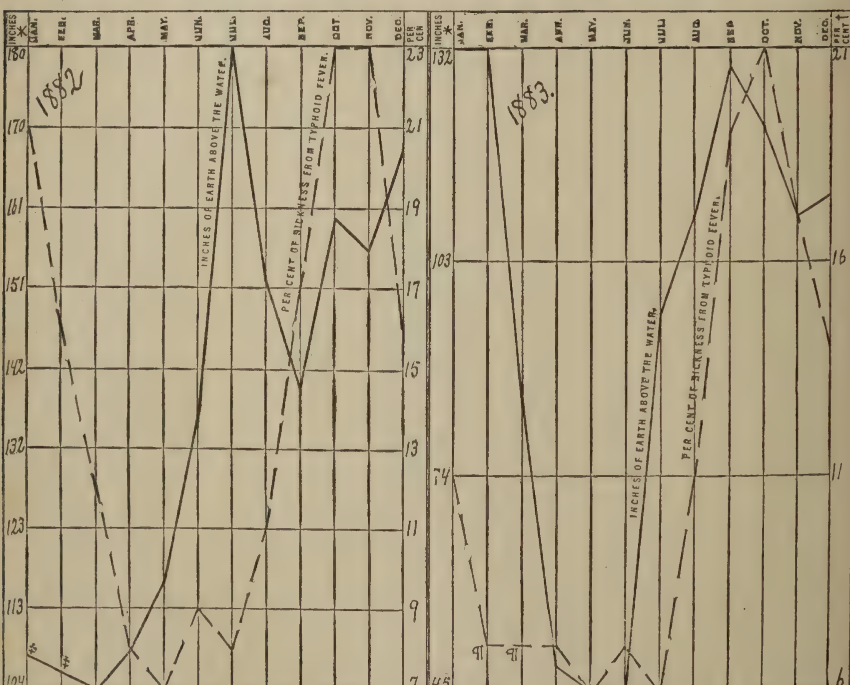


* Inches of earth above the water.
† Of all reports received for the given month, the per cent stating the presence of typhoid fever.
‡ Well-water high, but not protected by frozen ground; organic matter decomposing.
§ Depth of earth above the water least,—water highest; least sickness from typhoid fever.
‖ Depth of earth above the water greatest,—water lowest; most sickness from typhoid fever.
¶ Well-water low, but protected by frozen ground.

curve of the sickness should follow the curve representing the lowering of the water, because the statement of the sickness is, What per cent. of weekly reports received stated that typhoid fever was under observation during the week for which the report was made; and as the disease lasts for about three weeks, and as cases taken sick in preceding weeks will remain under observation until death or convalescence, and be reported together with those just taken sick, the curve for sickness would, when rising or falling, necessarily lag behind the curve representing the cause of the disease by about the average duration of the disease. As there is in this disease an incubation period of varying length, but which may be ten days, two weeks, or even more, this would still further postpone the sickness, compared with a curve representing its cause. Usually a few days of sickness pass before the doctor is called and the disease recognized and reported as typhoid fever. So that, if low water causes the sickness, we would expect, as a rule, to find the changes in the amount of sickness to appear to lag behind the changes in the level of the water by about one month. This is very nearly what we do find shown by Diagram A, on page 190, relative to the average for the five years,[1] and with respect to each of the years 1878, 1880, 1881,

[1] If the diagrams were made by weeks instead of months, it might be found that the relation is more definite and constant than appears by these diagrams, but this remains to be ascertained.

DIAGRAM C.—*Exhibiting the Rise and Fall of Water in Wells, and of Sickness from Typhoid Fever, in Michigan, by Months, during each of the Years 1882, 1883.*



* Inches of earth above the water in wells.
† Per cent of reports of sickness from typhoid fever.
‡ Well-water high, but not protected by frozen ground; organic matter decomposing.
¶ Well-water low, but protected by frozen ground.

and 1883, namely, that the rise or fall of the disease appears to be greatly influenced in any month after May or June, by the level of the water in that same month, but that the influence extends over into the succeeding month.

The comparison between the depth of water in wells and the sickness from typhoid fever being so close for every month after June, what is the reason for the want of correspondence in several years from January to June? By the diagram for the year 1881 it may be seen that the earth above the water increased from January to March and decreased from March until June, while the sickness seemed to decrease because of the low water in wells in March, and to increase in consequence of the rise of water in April. In considering this subject, it seemed to me that the cause of the low water in March, 1881, might be the great depth to which the ground was frozen; and that the reason why the sickness was decreased might be that the privies and other sources of typhoid contamination were also frozen, and the liquid therefrom prevented from descending to the water in the wells. The water in the wells would then be derived in greater proportion by percolation from a distance, in some cases from streams not frozen. In either case, whether the water in wells came from a distant stream above ground, or from the general level of the ground-water, the ground above being frozen deeply, the water which enters the wells would be filtered much more slowly through the deep strata of the earth than is the case when rain passes freely down to wells through foul surface-soil. To learn whether this supposed explanation accorded with the facts, I have turned to the reports by the meteorological observers for the state board of health of Michigan, and I find they reported relative to the weather in the first part of the year 1881, as follows:—

January.—"January was a very cold month. Ice about 25 inches thick; ground deeply frozen."—*John S. Caulkins, M. D., Thornville.* "January, 1881, was the coldest, judging from its mean temperature, of any January since 1875. The mean temperature was 14°."—*Sergt. Jas. A. Barwick, Alpena.*

February.—"Nights of February 23 and 24 were the coldest recorded since the first opening of the signal office in this city, minimum thermometer registering 27°."—*Sergt. Jas. A. Barwick, Alpena.* "The month has been stormy and quite variable in temperature, which is below the mean of several years."—*John S. Caulkins, M. D., Thornville.* "Ground frozen four feet deep."—*Lee S. Cobb, Winfield.* "Frost four feet deep in the cemetery; soil, sand and gravel."—*Francis D. Parmelee, Hillsdale.* "Thickness of ice put up in ice-houses, 26 inches. Average depth of frozen earth in cemetery, three feet.—*Edwin Stewart, M. D., Mendon.*

March.—"Ground frozen to the depth of 18 inches."—*Sergt. Jas. J. Fitzgerald, Alpena.* "About five inches of snow on the ground as the month ends. Frost in the ground is not deep. The lakes and ponds are still frozen. A very wintry March."—*John S. Caulkins, M. D., Thornville.* "Ice began to move in Grand river March 28."—*Lansing.*

April.—"Ice in bay beginning to crack in many places; will soon be gone; navigation not yet open."—*Sergt. Chas. Dill, Escanaba.* "Frost disappeared from the ground about the 25th. Navigation opened on the 29th."—*Sergt. Jas. J. Fitzgerald, Alpena.* "April has been a cold, backward month, and closes with the prospect not improved. Remains of snow-drifts were seen as late as the 22d."—*John S. Caulkins, M. D., Thornville.* "Depth of ground frozen, three and one half to four feet. Time of disappearance of frost from the ground, about the 25th."—*H. Peters, Tecumseh.*

The great depth to which the ground was frozen in February and March will, I think, explain the great freedom from typhoid fever in Michigan in March, 1881. If this is the true explanation, it indicates that the condition of the low water in wells is generally not productive of typhoid fever when the comparatively low water is protected by a deep freezing of the privies, cesspools, and the general surface of the earth. We have previously seen, and it is apparent from several of the diagrams which I present, that from June to December low water in wells is not favorable to freedom from typhoid fever.

Turning now to the diagram representing the relation of water in wells to typhoid fever in Michigan in the year 1880, it is noticeable that in the early months of that year the water was high (the depth of earth above it was not great), and that the typhoid fever was also high. The reasoning adopted relative to the early months in 1881, where the deeply-frozen ground was believed to have prevented typhoid fever, would lead us to suppose that the well-water was not protected by frozen ground in 1880. Inspection of the records (in the Annual Report of the Michigan State Board of Health) shows that this is true, that in Michigan the earth was not as deeply frozen as usual during the months of January and February, 1880. In January the average temperature for 15 stations in different parts of Michigan was above the freezing point, being 34.06° F. In February, the average was 27.93°, and in March, 31° F. Dr. Stewart, observer at Mendon, in south-western Michigan, reported:—"Considerable plowing has been done in this county during the month of January;" Dr. Caulkins, observer at Thornville, reported for January, 1880:—"There is no snow; no ice in the streams and ponds, and scarcely any in the ground." Dr. Peters, of Tecumseh, reported for February:—"Frost all out of the ground February 28. Streams froze up and thawed out three times during winter; ice at no time more than six inches thick. Not more than half the usual amount of ice was put up." Dr. Caulkins reported for February:—"The ice crop is a total failure. February has been very mild for this latitude; and so much freezing nights and thawing days has materially injured the clover."

The unusual prevalence of typhoid fever in Michigan in February, 1880, is probably fairly attributable to the unusually mild weather in January and February, and to the lack of protection usually afforded by the frozen ground at that season of the year to the water in wells, which water, by reason of the injury to vegetation by alternate freezing and thawing, was probably unusually contaminated by decomposing organic matter, in addition to the leaching from privy-vaults.[1]

[1]In this connection the following from the Massachusetts Board of Health Report for the year 1871 is of interest:—

"A large house in this village [Sutton] is supplied with water from a well in the front yard, three rods from the house. Connected with the house is a barn without cellar, some three rods from the well. In December, 1868, a trench three or four feet deep was dug from the well to a point near the middle of the barn, where a pump was set, and a pipe connecting it with the well was laid in the trench; after which the earth, which was in large frozen chunks, was filled back into the trench. In the house was kept a boarding-school for boys, of whom there were ten or twelve. Three little girls were also there, aged twelve, eight, and three years, belonging to the family of the owner of the

From the evidence in the tables, diagrams, and comments in this paper, it may be seen that not only in the spring of 1880, but in the early part of other years, typhoid fever was prevalent coincidently with an unfrozen surface of the ground. The year 1882 is another example of high ground-water and high rate of sickness during the first few months of the year. By reference to the reports of meteorological observers for the Michigan State Board of Health, it is found that February and March, 1882, were unusually mild months. The observer at Lansing records for February:—"Frost Feb. 9. River opened Feb. 13, closed Feb. 21, and opened again Feb. 25. Robins came back Feb. 22." Dr. Caulkins writes at the close of February:—"Nights that no ice formed, 7, 12, 13, 16, 27, 28. A warm and pleasant month for the season, with no sleighing, and noteworthy for the six days without freezing. Wheat seems not to be in the least injured by the freezing and thawing and the lack of snow, but looks excellent. As the month goes out there is not a particle of ice in sight, and little frost in the ground. Robins came back as early as Feb. 22, and blue-birds soon after. Blue-flies and mosquitoes have been seen." Dr. Caulkins writes again at the close of March:—"March, in spite of some cold weather, has been a warmish month. As it closes there is scarcely any ice in the ground. Wheat looks uncommonly well, but the last year's seeding of clover is pretty much all killed by the repeated freezings."

We thus reach the conclusion that, in Michigan at least, the relation of the depth of water in wells to typhoid fever is not the same in summer as in winter;—that in summer, when vegetation is active and not decaying, a lowering of the water is uniformly followed by increased prevalence of typhoid fever; with the advent of colder weather there is a rise in the water-level which is uniformly followed by a decreased prevalence of the fever; that this decrease continues through the winter and spring, even though the level of the well-water is lowered, provided the surface of the earth is deeply frozen; that, on the contrary, high water-level in wells in winter and spring, coincident with ground not thoroughly frozen, is followed by increased prevalence of the fever. Briefly stated, the typhoid fever follows low water in summer, and high water at that

house; there were therefore fourteen or fifteen children who drank from the well. The oldest boy was seventeen or eighteen years old, while the others were of ages from ten to thirteen. Everything went well until after the thaws in February and March, 1869, when the water had a decided taste and smell of stable manure. March 26, one of the boys, thirteen years old, was seized with typhoid fever; another, twelve years old, on the 31st of March; another, eleven years old, April 2; another, ten years old, April 4; and another, twelve years old, April 9. April 20, one of the little girls (eight years old) was seized. Each of these six children (all of whom finally recovered) drank water with their meals from the well in the yard. Some of the older boys drank coffee in the morning and tea at night. The manner in which these children were attacked, and the fact that this house had been free from typhoid fever for many years, and the water heretofore known to be very pure and wholesome, lead me to the conclusion that the use of the water thus impregnated was the cause of the disease occurring where and just at the time it did. My theory is, that while the ground, manure, etc., under the barn were frozen, the water was all right; but when it thawed, and the previously frozen filth leached through the soft and loose earth along the track of the pipe into the well, the effect of the poison was felt most perceptibly by those who used the polluted water most freely, while those who used it less freely escaped entirely."

season of the year when the ground is usually thoroughly frozen. (Although I find little evidence of it as yet, we may expect to find that high water in winter and spring may not necessarily be followed by increased prevalence of fever, if it is coincident with a deeply and continuously frozen surface of the ground.)

As regards bronchitis, pneumonia, and other diseases caused by cold weather, it does not seem to be true that they are more prevalent in a mild than in a severe winter. But as regards typhoid fever in its relations to contamination of ground-water, as herein set forth, there seems to be a partial explanation of the old saying, "A green Christmas makes a fat churchyard."

WHAT CONSTITUENT OF THE DRINKING-WATER CAUSES THE TYPHOID FEVER?

Typhoid has been known to occur after the drinking of water contaminated by decomposing vegetable matter (turnips in one instance[1]); by decomposing animal matter (a turtle in one instance[2]); also in the autumn succeeding a hot summer in which diarrhœa had been unusually prevalent; and the unusual fouling of the water-supply by the extra quantity of fecal discharges under these circumstances has been supposed to have causative relation to the typhoid fever which succeeded it. All this receives explanation, if we accept the doctrine that typhoid fever is caused by bacteria; because bacteria require for their growth and multiplication a nutritive solution,—either mineral (such as Pasteur's), or vegetable, or animal,—very few, if any, of the many species of bacteria being able to reproduce themselves in great numbers in pure water. This last statement seems to me to be evident to those who have used the microscope much; yet I may quote from a high authority as follows: Dr. Robert Koch, in his recent address on cholera, before the Imperial German Board of Health, is reported to have said,—"I would not certainly assume that the multiplication of the comma-bacillus outside of the human body takes place in well-water or in river-water without any assistance, for these fluids do not possess that concentration of nutritious substances which is necessary for the growth of the baccilli."[3] Dr. Koch was, however, able to reproduce the comma-bacillus in meat-juice, and other nutritive solutions. After mentioning the growth of bacteria in stagnant water, and that "the continuous flow of water prevents the formation of a local concentration of nutritive substances in the liquid sufficient for pathogenic bacteria," Dr. Koch further says,[4]—"The connection between the falling of the subsoil-water and the increase of several infectious diseases, I would explain as follows: That when the subsoil-water falls, the current that takes place in the subsoil-water is much less significant. Besides, the quantities on the surface are much

[1] *Sanitary Record*, London, Jan. 29, 1876, vol. iv, pp. 81–82.
[2] *Annual Report Mich. State Board of Health*, 1876, pp. lxii–lxiv.
[3] *British Medical Journal*, Sept. 6, 1884, page 456.
[4] *British Medical Journal*, Sept. 6, 1884, page 456.

diminished, so that those concentrations, which I assume to be necessary for the growth of the bacteria, must much sooner take place." I venture to suggest that the evidence we now have of the causation of typhoid fever renders it necessary that we substitute for Dr. Koch's diminished quantities of fluids "on the surface," diminished quantities of water in wells as more directly causative of typhoid fever; because that disease is not frequently traced to transmission through the air, but is frequently traced to the use of bad water; so that, aside from such evidence as that which I present to you at this time, we have good reason to believe that in some way typhoid fever is frequently caused by the drinking of contaminated water. The cases recorded are exceedingly numerous. References to a few of them are as follows:—

NEUCHATEL OUTBREAKS.

A mild, extensive epidemic of typhoid fever occurred in Neuchatel, Switzerland, in the fall of 1882. There were six hundred and twenty-three cases between September 14 and October 20; and the total cases in the period covered by the epidemic included five per cent. of the entire population. All classes were taken, and the outbreak occurred in all parts of the city at the same time. The water-drinkers suffered most, and so far as reported, those who drank only beer escaped entirely.

The city water-supply is brought by an aqueduct from the Seyon, a mountain stream, torrential in spring and during rains, but small in summer. This stream with its affluents drains the Val-de-Ruz, and on its banks above Neuchatel are many small villages. A careful investigation, authorized by the government, showed the following condition: The drinking-water is taken from the Seyon, directly below the town of Valangin. There are twenty other little villages higher up the valley. Slaughter-houses, pig-sties, cesspools, sewers, and privies were found in close proximity to the stream, and with liquid contents oozing in some cases directly into the stream. A public laundry, much used by several villages, is also situated on the banks of the stream, and the wash-water flows directly into it. Ordinarily the water of the Seyon is pure, but during heavy rains the filth from above mentioned sources is washed into the stream in large quantities, and gives to it a turbid aspect. A committee, which examined the condition of the Seyon below Valangin and above the point from which the Neuchatel water-supply is taken, immediately after a heavy rain, declared the stream to be "nothing but a vast drain, the water being absolutely unfit for alimentation." Some weeks prior to this outbreak at Neuchatel, there had been cases of typhoid in nine of the small villages above Neuchatel, and also about fifty cases of an infectious gastritis, thought by some to have been a mild typhoid. These cases were followed by a series of heavy rains, and these in turn by the typhoid outbreak at Neuchatel. In the fall and early winter of 1875, after continued heavy rain, there was an analogous outbreak of typhoid fever in Neuchatel, preceded some weeks by sporadic cases of the fever in the Val-de-Ruz. (L'Eau du Seyon et La Fievre Typhoide a Neuchatel. Par Dr. Guillaume. Neuchatel, 1882.)

NEUCHATEL R. R. STATION OUTBREAK.

Dr. Favarger relates (*Feuilles d' Hygiene*, November, 1879), that being called in the early part of 1878, as physician to the railroad company, to care for a series of more or less grave cases of typhoid fever (14 cases, 3 deaths), confined exclusively to the employés of the railroad station at Neuchatel, he made an investigation, and found that some weeks previous the son of an engineer in charge of the water-works had been taken with the fever, and had been cared for in the building which contained the hydraulic ram used for forcing water from the lake into a reservoir, from which the station eating-house and the locomotives were supplied; he found that a portion of the excreta of this boy had passed into the lake near where the water-supply was taken, and had undoubtedly been pumped into the reservoir, and then consumed by the employés of the station.—(Cited by D. Guillaume, as above.)

BRANHAM SCHOOL OUTBREAK.

At the college of Branham, Yorkshire, Eng., two pupils were taken with typhoid fever, in February, 1869, the discharges being thrown into the water-closet. Toward the end of the next month there was, all at once, an outbreak of sixteen cases of fever in the school. Investigation showed (1) that all the pupils ate the same food, while only a part were stricken; (2) that the beer-drinkers were regularly spared by the disease; (3) that the disease seemed to single out the water-drinkers. These facts threw suspicion on the drinking-water. Further investigation showed that a defective soil-pipe had allowed the typhoid excreta to pass from the water-closet into a reservoir of fresh water, and that the well water had been polluted by infiltrations from this reservoir. The fact that the food was cooked in this water would go to show that heat destroyed the typhoid poison.—(Dr. Anker, as quoted by Dr. Guillaume.)

UPPINGHAM OUTBREAK.

During the month of October, 1875, fifty-one cases of typhoid fever occurred in a school at Uppingham, England. There had been one case of this fever (terminating fatally) in this school in the preceding June, and no sanitary precautions had been taken. The lad died at the commencement of the midsummer holidays. Two cases occurred between Sept. 21 and Sept. 28, and twenty-eight others between this date and Oct. 12, up to which time no sanitary precautions appear to have been taken. The excreta from these cases went into large, full, and extremely foul cesspools in proximity to wells,—afterwards shown to be polluted. The contents of some of these cesspools were pumped upon the garden for fertilization purposes, and drained into a stream, in the polluted water of which the boys were accustomed to bathe. The sewer-gas from these cesspools, into which the typhoid excreta were thrown, penetrated almost without hindrance not only the water-closets, but also the living and study rooms of the school. It will thus be seen that, whether the cause of the fever was gaseous or particulate, given a first case in this school, there was *a priori* every reason to suppose the disease would spread, as it afterwards did. This outbreak was carefully investigated by Dr. A. Haviland, medical officer of health, who considered the outbreak to be the result of gross neglect on the part of the school authorities and the physician in charge.—(The Late Visitation of Typhoid Fever in the School and Town of Uppingham. London. E. & F. Spon, Publishers.)

ARMLEY OUTBREAK.

In an epidemic of typhoid fever occurring at Armley, in the Borough of Leeds, England, which was investigated by Dr. Ballard, of the Local Government Board (Reports of the Med. Officer of the Privy Council and Local Gov't Board, New Series, No. II, London, 1875, pp. 79–91), one hundred and seven cases occurred between July 7 and Sept. 7, 1873. The milk supplied by a certain dairyman, who had himself been ill of this disease in May, was shown to be the cause of the outbreak. "The manner in which the fever picked out the customers of the dairyman in various rows and blocks of houses, sparing other families, was indeed remarkable. * * * * As to the mechanism of the distribution of the fever from the dairyman's premises, there arises at the outset a question which it is desirable to answer, but to which, in the nature of things, a direct answer can hardly be expected. Was it water added to the milk that produced the enteric fever among families supplied from the dairy? No one knows anything of enteric fever being propagated by cow's milk *per se*, while there is very ample knowledge about the spread of such fever by means of water. The following considerations lead one to believe that it really was not through milk, but through water added to milk, that the customers of Hall Lane dairy got their infection of enteric fever. Houses occupied by families supplied from this dairy were invaded freshly, one after another, almost every day up to July 27; on that day three houses so occupied came freshly under medical notice, and from that day the epidemic, as such, was at an end. In the whole of the next week only one family dealing with the Hall Lane dairy applied newly for medical aid. This sudden cessation of the fever epidemic among this section of the community on July 27, means that the cause of the epidemic had ceased for them a fortnight or more previously, since in enteric fever there are

commonly 11 days of incubation, and several other days before medical advice for its symptoms is sought. July 10 would therefore be about the time when the cause of the epidemic among customers of the dairy suddenly ceased to operate. Now, on July 10, Dr. Robinson had the handle of the pump at Hall Lane dairy chained up, and thenceforth it was kept chained. There was coincidence, therefore, between the cessation of the fever and the cessation of the opportunity that the dairy had to supply a particular water; while there was no suggestion that the cows or their milk had undergone any change." Did subsequent investigation of the water-supply (in which the milk cans were known to have been washed), show it to be contaminated? Dr. Ballard leaves no doubt on this point. He says that the entire premises were in a filthy condition. Close to the well was an old urine tub in use; a very large dung-pit full of filth and manure was situated about 15 feet from the well in one direction, and the privy used by three cottages (and full of liquid excrement) was only a little farther off in an opposite direction. This well was 36 feet deep, loosely bricked up without cement for the upper 22 feet, the lower 14 feet being in shale. "For the first four feet from the top of the well the outside of the brickwork was pudded with clay, but not lower. All the way down below the place where the pudding ceased there was observed an oozing of black matter between the bricks, and below the spot where the brickwork ceased the oozing was considerable, as shown by the staining ot the stony portions of the soil, and by a black stain 12 inches wide, on the side next the dung-pit reaching to the water two feet lower down. There was a deposit of mud and filth at the bottom of the well which gave off abundant bubbles of gas on being disturbed." Analysis of the well-water showed much contamination from fecal matters. There had been considerable rain in the last part of May, toward the close of the dairyman's sickness. The excreta had been thrown into the privy, and also, in all probability, owing to the slovenly habits of the family, into the dung-pit and the urine tub, which were very near the well.

LAUSANNE (SWITZERLAND) OUTBREAK.

"The case in which the poison of typhoid fever mixed with drinking-water was transmitted through nearly a mile of porous earth, and which was mentioned in the abstract of my discourse to the Fellows of the Chemical Society (*Nature*, Vol. xiii, p. 331), is fully described (in German) in the sixth Report of the Rivers Commission on the Domestic Water Supply of Great Britain. It will shortly appear in English in the monthly journal of the Chemical society. Meanwhile, perhaps I may be allowed to trespass upon your space with the following remarks:—The outbreak of typhoid fever occurred at the village of Lausanne, near Basel, Switzerland, and it was exhaustively investigated by Dr. A. Hagler of Basel, who has given a full account of it in the 'Deutsches Archiv. f. Klin. Med. xi.' The source of the poison was traced to an isolated farm-house on the opposite side of a mountain ridge, where an imported case of typhoid, followed by two others, occurred shortly before the outbreak. A brook which ran past this house received the dejections of the patients, and their linen was washed in it. This brook was employed for the irrigation of some meadows near the farm-house, and the effluent water filtered through the intervening mountain to a spring used in all the houses of Lausanne, except six which were supplied with water from private wells. In these six houses no case of fever occurred, but scarcely one of the others escaped. No less than 130 people, or 17 per cent. of the whole population, were attacked, besides fourteen children, who received the infection whilst at home for their holidays, and afterwards sickened on their return to school.

"The passage of water from the irrigated meadows to the spring at Lausanne was proved by dissolving in it at the meadows 18 cwt. of common salt, and then observing the rapid increase of chlorine in the spring water; but the most important and interesting experiment consisted in mixing uniformly with the water 50 cwt. of flour, not a trace of which made its way to the spring, thus showing that the water was filtered through the intervening earth and did not pass by an underground channel.

"These are the main features of the case according to the works above cited. It affords a clear warning of the risk attending the use for dietetic purposes, of water to which even so-called purified sewage gains access, notwithstanding that, as at Lausanne, such water may have been used with impunity for years, until the moment when the sew-

age became infected with typhoid poison. E. FRANKLAND." Quoted from PUBLIC HEALTH, April 14, 1876, page 266.

SYRACUSE (N. Y.) OUTBREAK.

The history of this outbreak is very clearly set forth in an article on "Typhoid-Fever Poison" (*Popular Science Monthly*, N. Y., Feb., 1879), by Dr. Eli Van de Warker. Sixteen cases of the fever were traced to one previous case, and the subsequent defilement by excreta, from this case, of one of the neighborhood wells by overflow of privy during a heavy rain-storm. People living on the same block or across the street, and under similar conditions, except as to the water which they drank, escaped entirely, although many of these same people were up night and day caring for the afflicted families.

GERMAN TROOPS AT WITTENBERG.

In some respects one of the most interesting outbreaks of typhoid fever ever recorded occurred, in the summer of 1882, among the troops of the Third Brandenburg Infantry Regiment, garrisoned at Wittenberg, Germany.

A full and admirable report of this outbreak by Staff Surgeon Dr. Gaffky is given in the last volume of the Report of the Imperial German Board of Health (Mittheilungen aus dem Kaiserlichen Gesundheitsamte, Band II, Berlin, 1884), pages 403–420.

Between June 11 and July 12 there were ninety cases of the fever. This outbreak occurred very suddenly, and was confined almost exclusively to the troops of one battalion of the regiment. Citizens upon whom part of these soldiers were quartered escaped, as did also the officers. This sudden and severe epidemic at once attracted government attention, and the investigation which followed is very characteristic of the thorough way in which the Germans do things. Dr. Gaffky was detailed to make the investigation, with the approval of the minister of war, and under the direction of the imperial board of health. By a rigid induction, every step of which is clearly detailed, Dr. Gaffky reached the conlusion that some weeks previous to the outbreak the well in the yard at the barracks had been infected by innumerable "typhoid seeds" from a neighboring privy, and that the use of the water of this well was the cause of the sickness. The citizens, officers, and soldiers not attacked escaped because they did not use the water of this well.

Two wells supplied the water used by the troops. Chemical analysis and careful inspection showed both wells to be badly contaminated, but in different ways. One well was situated in the yard of the barracks near a privy. The water of this well was used for dish-washing, washing canteens, and scrubbing purposes, and to some extent for drinking purposes, but was not used for this purpose by the officers nor by many of the troops because the water was not so good as that brought from the street well. Into the privy typhoid excreta had unquestionably been thrown in the months immediately preceding this outbreak. The strata between this privy and the well were for the most part coarse sand and gravel, easily permeable. The privy vault had two openings in its walls, and through these its liquid contents had oozed into the surrounding soil. The subsequent movement into the ground-water and thence into the well was facilitated by three factors,—(1) the lowness of the water in the well, (2) the increased amount of water which was drawn from the well at that season of the year, and (3) the movement of the ground-water itself, which was found to flow from the privy toward the well.

The other well, much used by the citizens as well as by the troops on account of the better appearance and taste of the water, is located in the middle of the neighboring Burgomaster street. No cases of fever resulted from drinking the water of this well, although it was very foul. The manner of defilement of this well was as follows: The horse-dung and other filth and rubbish of the street were supposed to be washed by rains along a pavement gutter to the northward away from this street well; but owing to a settling of the pavement there was a sag towards this well, and during rains the wash of the street actually poured into the well, and was pumped up and drank. Nor was this all: beneath the pavement there was found a well defined little gutter leading directly into the well. This befouling of the well had apparently occurred during every rain for a long time, and yet no typhoid fever resulted from drinking this water, because no typhoid germs had found their way into this well. If typhoid dejections had at any time been

cast into the street, they would in all probability have been washed into the well during the next rain-storm. The author thinks there is no reasonable doubt that in such an event an epidemic such as was traced to the well in the yard at the barracks would also have resulted from drinking the water of the Burgomaster street well.

ADRIAN OUTBREAK.

In the fall and winter of 1883–'4 an outbreak of typhoid fever occurred at Adrian, Michigan, in which there were fifty-three cases with eight deaths. Over one third the cases were pupils at a German Lutheran school in the house of the teacher, which house had for many years been used as a hotel, and at which was a well (in use by the family, the pupils, and others), very near which (from 25 to 56 feet) were an overflowing privy-vault, several old filled privy-vaults, two other privy-vaults in use, and a barnyard; there was also a drain or sewer (laid in June, 1883), in which, six feet from the well, was a leak from which the contents of the sewer flowed toward the well, forming a little cesspool in the gravelly soil only three feet from the well wall, which was of brick laid up without mortar,[1] and from which cesspool the contents undoubtedly leached into the well. The well was 36 feet deep, with four feet of water at the time of examination, October 24. Examination of the water with a microscope revealed vibriones and other organic matter, animal and vegetable. Analysis of the water showed sewage contamination. Twenty-one (of about eighty) pupils were sick, all of whom presumably drank of the water. Thirteen other persons who used water from the well were sick. Of the other nineteen cases, eighteen were in the families of pupils, or of persons who used the water and were sick, and but one was not traced thus directly or indirectly to this well, and he attended another German school in the neighborhood of this well.

The first case was a son of the teacher (about six years old), who was taken sick September 7. Discharges from this patient were thrown into a catch-basin three feet from the well, connecting with the drain or sewer, and into which catch-basin passed the overflow from the pump. Because of the leak above mentioned, if not otherwise, these typhoid discharges without doubt reached and infected the already foul water of the well. September 24, seventeen days after the first case was taken sick, the second case occurred. The third came down September 27, both in persons using water from this well. The fourth case attended a German school on a lot in the rear of the lot where the bad well was, and cornering with it, but, it is stated, did not use the water from this well. He came down October 1. Cases from the fifth to the thirty-fourth, inclusive, came down from October 2 to October 22, as follows: Two, October 2; one, October 5; one, October 6; three, October 7 six, October 8; four, October 9; one, October 10; two, October 11; one, October 14; one, October 15; one, October 16; two, October 17; one each, October 19, 20, 21, and 22; and one at a date not so definitely ascertained. Of these 30 cases, 20 were pupils of the school, 9 were other persons who used water from this well, and one (a brother of one of the pupils taken sick October 9) was a pupil at a third German school, across the street, and about 12 rods from the one where the bad well was, and was himself taken sick October 9, but is said not to have drank from the bad well.

The physician who treated the first and third cases was called to the third (his second) October 4, which day, at his request, the use of the water from this well was discontinued; but before the use of the water was discontinued, the thirty persons (pupils and others who used the water) who were taken sick from October 2 to October 22 had an opportunity to become infected from this water.

After October 22d there were no more new cases till November 5th; then began a second series of nineteen cases, all but two of them in the families (mostly in two families) of previous cases, which nineteen cases were taken sick at dates as follows: One each, November 5, 7, 8, 13, 19, 21, 24, 27, 28, December 1, 4, 13, 15, 19, 25, January 1 (1884), 4, 7, and April 1. Of these, eight were in one family (and its near and neighboring rel-

[1]According to another statement, the wall of the well had been relaid in water-lime in June before the sickness, at a time when it had been found necessary to have the well cleaned, the water having been reported as bad, pieces of dead earth-worms having been brought up by the pump, at which time the drain or sewer was laid. Whether all or part of the wall was relaid in water-lime does not appear.

atives), the first case in which was one of the pupils taken sick October 7, the second case being taken sick November 24; and four were in a family, the first case in which was the pupil taken sick October 15, and the second case was taken December 1; two (taken November 13 and November 21) were in a family in which two cases (one of them a pupil at the bad well) were taken sick October 9; three were in three families in which had been sick pupils, taken sick October 8, 9, and 8, and in which the second cases were November 8, 5, and 19, respectively; one of the other two was a near neighbor of a family in which were five cases; and one attended the German school across the street from the bad well, and drank from that well. Two of the second series of cases were users of water from the bad well, one of them being a pupil at the school where that well was. Concerning these it does not appear whether they used the water after it was infected by discharges from the first case (taken September 7). The interval is so great between the discontinuance of the water (October 4) and the coming down of these two cases (November 7 and 19) as to make it seem likely that they were infected in some other way than by water drank before October 4. Concerning the two cases in the first series, who are stated not to have used water from the bad well—it should be remembered that they attended schools near that well—one of them had a sister attending the school where the bad well was, and it does not seem unlikely that they may have visited the play-ground and drank at the bad well, as one pupil of the school across the street from the bad well is stated to have drank at that well.

Where and how the first case in this outbreak contracted the fever is not known, but typhoid fever is known to have occurred in a house near the school the year previous to this outbreak.

A longer report of this outbreak (not, however, including all the cases) is printed on pages 36–47 of the Report of the State Board of Health for 1884.

It appears to be established conclusively that in this outbreak the fever resulted from the use of foul well-water after it had become infected by the specific discharges from a first case. The facts developed may be summarized as follows:

1. Filth conditions likely to contaminate this well (the nearness of the privy-vaults and the barn-yard) had existed for a long time, without, so far as known, causing a case of typhoid fever. It had been found necessary to clean the well in June before the sickness. The leaky drain laid in June became another source of contamination. Unless M. H. (the teacher's son) was infected with the foul water, no case of typhoid fever resulted from the use of the foul water until excreta (containing the specific typhoid germs?) from a case (M. H., the first case) of typhoid fever were introduced into the water. Then, after about the usual period of incubation, other cases followed rapidly. If the teacher's son, M. H., was infected by water from the well, it seems strange that of the large number of persons using water from this well, no one else should have been infected at that time, and that no other case occurred till seventeen days after the first, especially as so many of those subsequently infected by the water were near the age of this first case, about six years.

2. After the first case of the fever occurred (September 7), seventeen days elapsed before the second case (September 24). This may indicate that the period of incubation was, in that case, seventeen days; or, if we call the period of incubation eleven days, it was six days after the first case was taken sick before his discharges were capable of causing the disease; or it took six days for the discharges to reach and so infect the body of water in this well as that it would cause typhoid fever; or those taken sick did not immediately drink of the water so infected. The third case occurred September 27, and the other cases followed rapidly (thirteen of them coming down on the three days, October 7, 8, and 9) until October 22.

3. The use of the well-water ceased about October 4.

4. In the first series, new cases ceased to appear about eighteen days after the use of the water from the condemned well was discontinued.

5. In the first series of cases, out of about eighty members of this school twenty had the fever, and all of these are believed to have used water from the infected well.

6. In this series, fourteen other persons, not members of the school, had the fever. All but two of these used the water of this well, occasionally or habitually. One of the two was a brother of one of the sick pupils.

7. The first series of thirty-four cases, with possibly one exception, was confined to persons using the water from this infected well.

8. The second series of nineteen cases, beginning November 5 and ending April 1, could not have been derived directly from the school well, (*a*) because but two of these persons used its water; and (*b*) because the first case of this second series occurred November 5, thirty-two days after the use of the well-water was discontinued.

9. Most of these nineteen persons might have contracted the fever from the infection of their own wells or drinking-water, (*a*) because this second series of cases all occurred in families whose children or near neighbors had contracted the fever at the school and had been nursed at home; and (*b*) because nearly all this second series of cases occurred in from three to six weeks after the first case in the family, and sufficient time after the first case in the family to allow for the infection of the home privy-vaults, and the subsequent infiltration of this infection through the porous soil into the wells, which infection of the water-supply may have been continued by subsequent cases in the same family.

An outbreak at Caterham, England, and a few other outbreaks, are mentioned on page 108.

TABLE 4.—*Inches of Earth above Ground Water, from Observations of Wells in Michigan, by Months for the five Years, and for each of the Five Years* 1878–'82, *also for* 1883.

Years. Number of Wells.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 5 years, 1878–'82 .	159	139	137	131	132	139	162	171	173	176	164	157
1878, at Elsie, . . .	96	96	84	90	90	96	102	120	132	138	120	108
1879, at Otisville, . .	. .	60	55	42	57	68	87	91	76	71	71	52
1880, av. at 4 stations *	231	231	230	222	226	234	244	261	263	260	253	244
1881, av. at 3 stations †	200	201	212	194	170	162	198	232	255	249	222	251
1882, av. at 3 stations ‡	108	106	104	108	116	136	180	152	140	160	156	168
1883, av. at 2 stations ‖	132	132	84	48	45	45	96	108	129	120	108	111

NOTE.—As the stations are different for different years, this table is useful rather for comparing months in the same year with each other than for comparing one year with another. The average line in Table 4 is represented in Diagram A, page 190; the lines for 1878 and 1879, in Diagram B, page 191.

IS THE CONSTITUENT OF THE DRINKING-WATER THAT CAUSES TYPHOID FEVER SPECIFIC? MAY THE DISEASE BE CAUSED BY MORE THAN ONE SPECIES OF BACTERIA? BY THE ORDINARY BACTERIA OF DECOMPOSITION?

The statistics show that in Michigan, typhoid fever in every year increases in prevalence in the autumn months, following the season of the year when there is most sickness from diarrhœa. With the unusual prevalence of typhoid fever in Michigan in 1881, beginning in July of that year, we must note the unusual prevalence of diarrhœa in that year, especially in June, July, and October. (There was most sickness from

* In 1880, at Thornville, Hillsdale, Mendon, and Union City. (Diagram B, page 191.)

† In 1881, at Thornville, Linden, and Dearborn. (Diagram B, page 191.)

‡ In 1882, at Brockway Centre, Otisville, and Woodland. (Diagram C, page 192.)

‖ In 1883, at Brockway Centre and Saginaw City. (Diagram C, page 192.)

diarrhœa in August; but compared with other years, the sickness in June, July, and October was very unusual.) Then, again, in the year 1882 the greatest prevalence of typhoid fever occurred rather later in the season than usual, as did also the diarrhœa, and as did also the highest monthly average temperature in that year. Whether the typhoid fever is very generally caused by diarrhœal discharges getting into the drinking-water, and whether the diarrhœa is sometimes caused by bad water under conditions the same as, or similar to, those which cause the typhoid fever, are among the many interesting questions in this connection upon which further evidence is desirable.

With reference to the causation of typhoid fever by air and water contaminated with diarrhœal discharges, we are indebted to Dr. W. Stewart, honorary surgeon to Beckett hospital, Barnsley, for facts and suggestions as to how the fever may thus arise.[1] Speaking of a series of cases of typhoid fever, Dr. Stewart says,—

"After careful inquiry, I arrived at the conclusion that the cause of this outbreak was to be attributed to the fact that the slaughter-house of a butcher was situated at the end of the row, into the common sewer of which the blood from his operations was allowed to flow, there to remain and putrefy. The waste-pipes from the sinks were directly connected with this drain without the intervention of any kind of trap, and the smell therefrom was often horrible. Here the putrefaction of a highly albuminous liquid, blood, in the drain, and a direct communication between it and the interior of the cottages, seemed to give rise to the fever." Dr. Stewart gives other cases, and then says,—"In the experiments instituted by M. V. Feltz, and communicated to the *Academie des Sciences*, upon the effect produced upon dogs by the injection of putrid blood, and alluded to in a contemporary (*Lancet*, vol. II, 1875, p. 460), the symptoms produced were very analogous to those we see in typhoid fever.

"'Putrid blood which has stood for several months was dried and desiccated in the air-bath and mixed with a certain quantity of distilled water, and injected into the crural vein of three powerful dogs. The animals immediately exhibited marked depression. After a period of incubation of from four to five days, febrile symptoms set in, accompanied by vomiting, loss of appetite, elevation of temperature, bilious and bloody diarrhœa, and biliary urine,' and these symptoms were produced even when all trace of bacterial life had disappeared from the blood injected." After referring to the typhoid condition in puerperal fever, attributed to decomposing blood, and referring to other considerations, he says,—"The question may now be asked, In what way is the origin of these cases, apparently arising from some component of putrefying blood, connected with the vast number of typhoid fever cases which appear to arise from the pollution of drinking-water by the excrement of human beings? In this manner, by fixing upon the serum of the blood as the essential factor of the poison, we at once see how any severe case of diarrhœa would be sufficient to produce the disease, because the liquid evacuation of severe diarrhœa is principally composed of serum blood, and it is drawn from a source and placed in a condition highly favorable to the development of the putrefactive process. * * * This theory of typhoid fever, arising from the decomposition of the serous evacuations of severe diarrhœa, accounts in a more satisfactory manner than any other for the extraordinary prevalence of the fever at a certain period of the year. It is a fact of universal observation, that enteric-fever cases reach their maximum, in point of numbers, in the months of October, November, and December; and this 'periodical disposition' to the disease is accounted for by Liebermeister (who believes that 'the real cause of every epidemic and every isolated case of typhoid fever is only the specific poison of typhoid fever' (Ziemssen's *Cyclopædia*, vol. I, p. 61), in the following manner:—He says

[1]*British Med. Jour.*, reprinted in PUBLIC HEALTH March 16, 1877, pp. 192–193.

(*ibid*, vol. I, p. 65), 'The curves representing the frequency of typhoid correspond to the curves of average temperature, only with this difference: the different points of the typhoid curve follow those of the temperature curve by an interval of some months; and in order to account for this discrepancy, he says it takes two or three months for the changes of temperature to penetrate to the breeding-places of the typhoid germs.' But if it can be shown that typhoid fever may arise from the putrefactive decomposition of blood-serum, then the abundant prevalence of summer cholera, from the end of July to the beginning of September, affords plenty of material for the elaboration of the poison, which afterwards percolates into the wells, or is washed by the autumnal rains into the sources of our water-supply." Dr. Stewart says,—"I do not propose to enter into the discussion as to whether the disease can have an abiogenetic origin, although the facts upon which my theory is founded appear to favor that doctrine. Whether the fever arises only from specific typhoid germs, which (according to the advocates of this theory) have a nearly omnipresent existence, and have the property of preserving their vitality in a dormant condition for many years, ready to spring into active and vigorous life when introduced into a proper nidus for their development; or whether the poison is manufactured from the ordinary germs existing in all the putrefactive processes which take place in certain animal fluids, or is elaborated by some subtle chemical change in the properties of the substance itself, does not signify so much to those who have to deal practically with the disease, so long as we can put our finger upon the factor, element, or pabulum without which these forces would be rendered permanently impotent. It is from the conviction that this pabulum will be found in albuminous liquids, such as blood, blood-serum, and the liquid discharges from the bowels in diarrhœa, and that the poison of typhoid fever is elaborated from the putrefactive changes which occur in them after their expulsion from the body and subsequent exposure to the air, that I have ventured to draw the attention of the profession to what appears to me to be a probable explanation of the origin of this disease."

I agree with Dr. Stewart, that a great practical point is gained when we know the materials and places in which the cause of typhoid fever is reproduced; but we also need to know in what way the cause of typhoid fever usually enters the body,—whether, as he seems to think it sometimes does, with the air which is breathed, or whether it is generally with the water which is drank; and I still think the question, whether or not the disease is specific, is an important one, to which we should seek the true answer. From the evidences of statistics, from clinical evidence, and from such evidence as to coincident conditions as those relative to well-water, etc., it may not be quite possible to decide whether the cause of typhoid fever is or is not specific; because, although we *can* say that the cause is associated with decomposing organic matter, of vegetable and animal origin, in drinking-water, and that it appears to be capable of reproduction, thereby making it extremely probable that the cause is organic, and probably one or more of the bacteria, many of such organisms are known to be able to reproduce themselves in meat-juice, and other fluids consisting of water and animal products, also in vegetable infusions, and even in mineral solutions, not directly derived either from animals or vegetables, as, for instance, in Pasteur's solution. Yet it is probable that by proper effort we may soon learn the truth, whether typhoid fever is ever caused by more than one species of bacteria, whether the cause of every case is derived from a previous case.

Bearing upon the question of a specific cause of typhoid fever, are many well-known outbreaks, especially those at Caterham and Red Hill,

England, at Lausanne, Switzerland,[1] and Dr. Austin Flint's cases at New Boston, N. Y. The history of the outbreaks at Caterham and Red Hill is substantially as follows:[2]—In the towns of Caterham and Red Hill, England, 352 cases and 21 deaths from typhoid fever occurred in a period of six weeks in 1879. Dr. Thorne, of the local government board, made a thorough investigation, and found that the cause of the outbreak could be very clearly traced to the defilement of the common water-supply of the two towns by the typhoid excreta of a workman employed at the water-works in the construction of an adit from an old well to a new bore which was being sunk. This man worked at the bottom of the adit, 455 feet below the surface, and was at the time suffering from a mild form of typhoid fever. The excreta of this man was hauled up to the surface in a bucket, and spattered over on the sides and the bottom of the adit, into which the water-supply was soon after admitted. The outbreaks occurred about two weeks after the infection of the water, and were confined entirely to those families using water from the pipe-lines. The cases at Lausanne, stated on page 199, also strongly indicate that the cause of typhoid fever is specific; and the cases recorded by Dr. Austin Flint can hardly be explained on any other hypothesis, nor can the cases reported by Dr. Gaffky. See in this article "German Troops at Wittenberg," page 200. The Adrian, Mich., outbreak, a synopsis of which appears on page 201, also supplies strong evidence that the disease was spread by the discharges from a first case infecting the drinking-water.

Klein,[3] Klebs,[4] and many other eminent histologists have thought that typhoid fever is caused by a specific bacterium, although they have not agreed as to which of several forms described should be considered the *true typhoid bacterium*. A recent view is, that the forms seen by Klein and Klebs in the diseased Peyer's glands are secondary invasions, and that the real cause of the disease is a peculiar, short, thick bacillus with rounded ends, found during the fever not only in the diseased Peyer's patches, but also in various other organs of the body, as the liver, spleen, and kidneys. This bacillus has been described by Eberth, Meyer, and Friedländer, and is believed by them to be specific. Koch has confirmed the statements made by these observers, and Ziegler says this bacillus is "probably the exciting cause of the disease."[5] The statements of Eberth, Meyer, and Friedländer have been again confirmed quite recently[6] by a series of very exhaustive and carefully conducted microscopic examinations by Dr. Gaffky, of the Imperial German Board of Health. These bacilli have been found by him in 27 out of 28 cadavers examined,

[1]Detailed on page 199.

[2]*Ninth Annual Report of the Local Government Board*, 1879–'80, pp. 78–92.

[3]Intimate Anatomical Change in Typhoid Fever: *Reports of the Medical Officer of the Privy Council and Local Gov't Board*, London, 1875. Also, PUBLIC HEALTH, June 16, 1876, page 463.

[4]Archiv fur exper. *Pathologie*, 1881.

[5]*Pathological Anatomy*, London, 1883, Part I, page 300.

[6]Zur Ætiologie des Abdominal typhus: *Mittheilungen aus dem Kaiserlichen Gesundheitsamte* Band II, 1884, pp. 372–403.

and have never been found, either by himself or by the other investigators named, except in typhoid cases. It is believed that the failure to find this bacillus in the twenty-eighth cadaver was because death had occurred at a late stage of the disease, when the characteristic symptoms of the disease had mostly disappeared, and at which stage of the fever this bacillus is much less frequent than at an earlier stage. Dr. Gaffky cultivated this typhoid bacillus outside of the body on various nutritive substances, as nutrient gelatin, meat-broth, fluid blood-serum, boiled potatoes, and also in vegetable solutions, although in the latter they grew less vigorously. All Dr. Gaffky's attempts to reproduce the disease in the lower animals proved futile; but inoculations of animals with cultures of typhoid bacteria are recently reported[1] to have been successfully made by two French scientists, MM. Tayon and Mozioconacci. The description of their experiments, however, leaves much to be desired by way of explanation and confirmation.

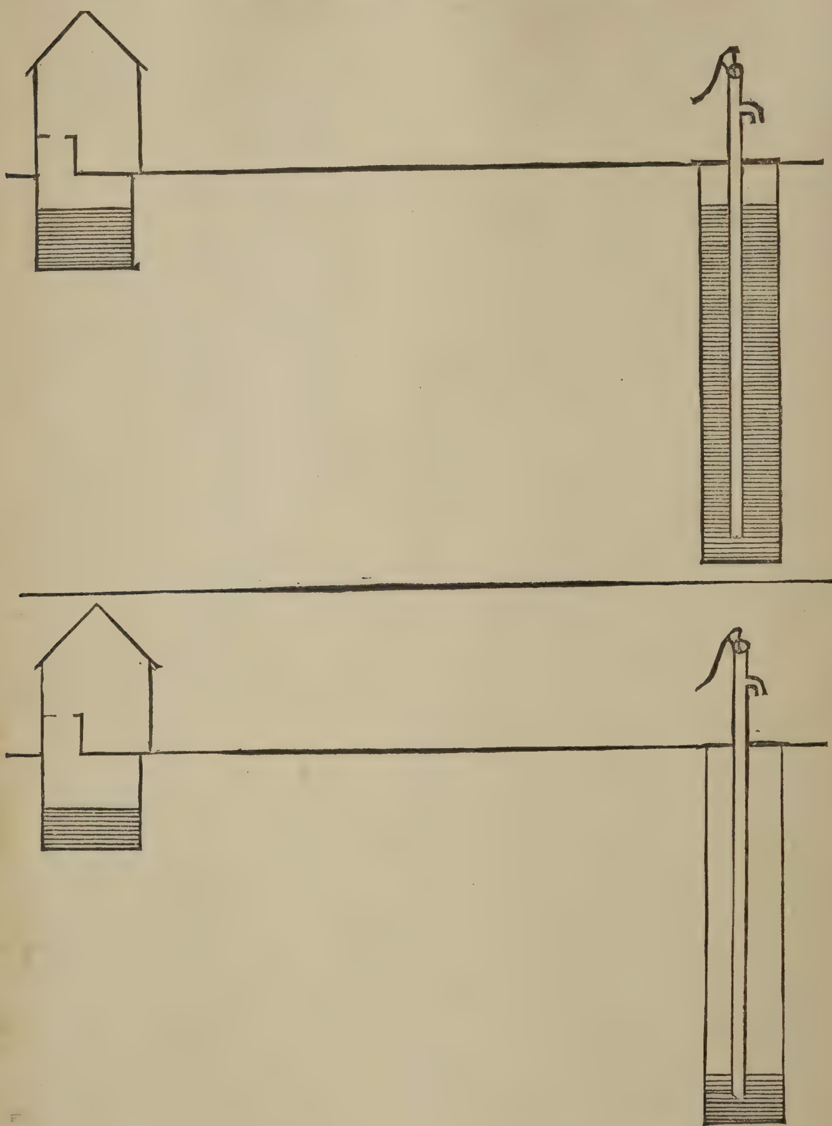
HOW IS TYPHOID FEVER INDUCED BY LOW WATER IN WELLS?

The evidence of the causation of typhoid fever by low water in wells will not be accepted by some persons, because they do not understand at first sight how the disease can be thus caused. Several persons to whom I have presented some of this evidence have replied that they could understand how dilution of a *poison* would lessen its effects; but that if typhoid fever is caused by a specific organism, they failed to see how the low water in wells could cause the disease. A study of the relations of privies to wells, and the statement of certain facts, may aid such persons to an understanding of how it is possible to explain such mode of causation.

On page 208 I submit a diagram showing a privy and a well under two circumstances: in one case the water in the well is low, and in the other case it is high. It would seem that when the level of the water is the same in the well as in the privy, there would not be likely to be a mingling of the water from the privy with that in the well unless the distance between them was small. But whenever and wherever the water in the well is below the bottom of the privy not far distant, there will be a strong tendency of the fluids cast into the privy to pass downward toward the water in the well, or, if not directly to the well, to the ground-water not far distant, which will pass into the well to replace that which is drawn. The quantities of solid and liquid filth deposited in privies probably do not vary much from month to month, except that because of diarrhœa in the hot months of July and August more fluid fecal matter probably enters them. The supposed causation of the regularly recurring increase of typhoid fever in the autumn, by discharges from persons suffering from diarrhœa gaining access to the drinking-water, is referred to in another part of this paper. That is only one way of rendering the water foul, or, as we might say, nutritive to bacteria;

[1] *Comptes Rendus*, Aug. 18, 1884, vol. xcix, pp. 331–334.

DIAGRAM D.—*Illustrating the Proposition that the Fluids Cast into a Privy bear a Relation to the Water in a Well Not Far Distant, which Relation is Different When the Water in the Well is High from What it is When the Water is Low.*



and it is quite in keeping with the other evidence referred to in this paper as to outbreaks of typhoid fever after the use of water contaminated by decomposing animal and vegetable matter. The explanation of all these lines of evidence would seem to be, that either the ordinary bacteria of decomposition cause typhoid fever, or that the specific cause of the disease is quite generally

distributed, *and is capable of self-multiplication outside of the body*, whenever it falls into fluids sufficiently nutritive. But even if the cause of the autumnal increase of typhoid fever is the diarrhœa which precedes it, and which is itself caused directly or indirectly by the high temperature, even then it would seem that under present circumstances the quantities of water in wells control the rise and fall of typhoid fever; because the relation which the curve representing diarrhœa bears to the curve representing the fever is not closer than is that borne by the curve representing water in wells; and it is probable that it is only by passing into the drinking-water that the diarrhœal discharges help to cause typhoid fever.

In the early autumn, also, there is more than the usual likelihood of a *specific cause* being introduced into certain wells, because then surface supplies of drinking-water, wash-water, etc., are diminished to such an extent that unusually large drafts are made on the wells. This increased use of well-water would lead to the drainage of an unusually large territory around the wells, with a consequently increased danger of contamination from privies infected by typhoid excreta.

I think we may now safely assume that there is a greater dilution of the dejections from typhoid-fever patients, and of human excreta generally, when the water in wells is high than when it is low, except when the low water is caused by a frozen ground which locks up the excreta on the surface of the earth. It cannot yet be positively asserted that the specific cause of typhoid fever is reproduced outside the body in nutritive solutions at the temperature of water in wells; yet this may be found to be possible, or, if not in wells, in the higher temperature of privy-pits, from which they may pass into the well, either at once in the form of mature bacilli, or after a time in the less perishable form of spores; and if typhoid fever is caused by the ordinary bacteria of decomposition, as many seem to believe, then we must consider that lessening the quantity of water in wells would probably (except as just mentioned) lessen the dilution of the fluid derived from privies, and consequently increase the proportion of bacteria thus introduced into a given quantity of well-water; and not only this, but the proportion of albuminoid matter suitable for the rapid reproduction of bacteria would then be increased; and, bearing in mind how rapidly the reproduction of bacteria occurs under such circumstances, we can well understand how in such a "culture fluid" there would soon be something of very much greater import than simply what would result from a lack of dilution of a fluid containing some organism or poison not capable of self-multiplication. Then, again, the ordinary bacteria are known to be frequently in much greater abundance on the surface than elsewhere in a liquid, because of their requirement of air; therefore a much greater proportion of bacteria would be likely to be drawn up by a pump reaching to the bottom of a well, when the top of the water falls to near the opening into the pump.

Many years since Chauveau[1] performed a series of careful experiments

[1] *Comptes Rendus*, lxviii, 1868, and lxxii, 1871

with vaccine virus, diluted with constantly increasing quantities of water, when he found that the proportion of successful vaccinations was correspondingly decreased. Under these circumstances, it appeared that whenever there was a lodgement of the virus the development of the case proceeded regularly to the close; but with large quantities of water the proportion of such cases of successful vaccination was very small. I suppose that no one now doubts that vaccinia is caused by specific particles which are reproduced within the body. (It is now many years since vaccinia was shown to be due to a "particulate" cause, and those same experiments by Chauveau had much to do with establishing that fact. However, Dr. Burdon-Sanderson's experiments verified those made by Chauveau, and have been considered sufficient to establish this point.) The two points just alluded to (the lessened chance of vaccination with diluted virus, and the fact that vaccinia is a specific disease) may serve to remind those who have not held these facts in mind that dilution of a fluid containing the specific cause of a disease lessens the chances of communicating that disease when the fluid is brought in contact with the body.

An objection has been offered, that the variations in the amounts of water in wells, as shown by the diagrams, were too slight to account for so great differences in the prevalence of typhoid fever as are shown to occur in Michigan in the months of June and October. The reply is, that the variations shown in the diagrams are mostly averages of several wells, and that in one of the wells included in the average for the year 1881 the amount of the variation was from twenty feet of water in the month of June to no water whatever in the month of September. Besides this, the wells measured are not the wells the water of which actually caused the typhoid fever in Michigan, but they are only examples of how the water rose and fell on the average. It is probable that many wells (besides one of those observed) were nearly dry at some period during or following the extreme drouth of 1881.

An instructive inference from the evidence which I present is either that the cause of typhoid fever does not long remain in the well-water in an active form, or that the dilution is so great as to reduce very greatly the chances of its producing the disease. As the water lowers in summer, the typhoid fever cause is apparently quick to act, and as soon as the autumnal rains filter into the wells its action quickly disappears, although it must be admitted that at no time of the year is the state entirely free from typhoid fever; and it is quite possible that the rapid subsidence of typhoid fever after the autumn rains is simply because of the extreme dilution of its cause in the wells.

THE CAUSE OF THE GENERAL ANTAGONISM BETWEEN INTERMITTENT FEVER AND TYPHOID FEVER.

It would lead us too far aside to treat fully here of the controlling cause of intermittent fever; but it may be allowable for me to say here,

that we now have possession of facts which, in my opinion, enable us to explain the general antagonism between intermittent fever and typhoid fever, and that the nature of some of these facts may easily be inferred, because high ground-water, with coincident high temperature of the air, is generally conducive to intermittent fever, and low ground-water is conducive to typhoid fever whenever the drinking-water is liable to be contaminated by typhoid excreta. The first-named condition is most frequently found in new countries, as yet undrained; the last named in localities which have long been settled, especially in large villages which depend upon wells for their water-supply.

WHAT NEED IS THERE FOR THE PREVENTION OF TYPHOID FEVER IN MICHIGAN?

For the five years, 1878 to 1882 inclusive, there were returned as having occurred in Michigan 2,586 deaths from typhoid fever (see Table 3 on page 187). This is an average of 517 each year; but we have reason to believe that the deaths returned are about one half of the number that occur. Therefore we conclude that, on the average, over one thousand persons die in Michigan in each year from typhoid fever. The proportion is not greater in Michigan than in other states.[1]

HOW CAN TYPHOID FEVER BE PREVENTED?

If the evidence which I have presented is conclusive, the reply to the above question may be stated in four words, namely, Stop drinking contaminated water. This might not prevent all the typhoid fever, but it would appear that by far the greater proportion of it in Michigan may reasonably be expected to be thus preventable. How to prevent the contamination of the various water-supplies cannot be so briefly stated; but if people care enough about it to take the necessary trouble to do this, sanitarians can tell them how. So far as it relates to typhoid fever, it may be that all that is necessary is to destroy and keep out of the water

[1]There is reason to suppose that a large number of deaths attributed to other diseases than typhoid fever are caused by impure drinking-water. In a paper entitled "Chronic Zymotic Disease Simulating Consumption," in the *Annual Report of the New Hampshire State Board of Health* for 1884, page 240, D. M. Currier, M. D., says,—"Another instance in point where the effect lay between typhoid fever and consumption, with a decided preponderance in favor of the latter, and caused by drinking impure well-water, was reported and published in the report of the State Board of Health [N. H.] for 1883, in which the analysis of the water is given (pp. 263–269). [The water was very foul, and was declared 'neither fit for man nor beast.'] On this farm nine persons died,—two of typhoid fever, one of gall-stones, and six of consumption,—the last of which was the only one that I had under personal observation. A general survey of the case would give one the impression that he was suffering from tubercular deposit in the lungs; but upon thorough examination of the chest, no evidence of tubercles could be found. There was equal resonance over both lungs, which were equally and fully distended by a forced inspiration. He had chronic laryngo-pharyngitis, with loss of voice. There was great and constant irritation of the stomach, as manifested by frequent nausea and vomiting of food, with progressive weakness and low vitality. This went on, and the man died, not, in my opinion, from tubercular consumption, but from what I believe to be chronic poisoning by the filthy water he drank."

all discharges from persons suffering from typhoid fever; but the difficulty of recognizing the disease early enough in its course is so great that in order to do this it will be necessary to keep all human excreta, and perhaps the excreta of some animals, out of the water-supply. Most people think they do this now, or probably we would not have a thousand deaths a year in one state from this cause; but I think we have reason to believe that their confidence in the purity of the water they drink is misplaced, and that consequently many of them sicken and die. The numerous instances where typhoid fever has apparently been caused by drinking-water contaminated by decomposing vegetable matter indicate that, even if the cause of the disease is specific, until such time as that the specific cause shall be so restricted as not to find access to water-supplies, it is important to preserve the water from contamination by vegetable as well as by animal matter.

NOTE.—In this paper the design has been to present one line of the evidence on this subject, which during the past ten years has been collecting in the Annual Reports of the Michigan State Board of Health, in the office and library of the board, and in the mind and manuscript of the writer; and in doing so, much of the interesting evidence which has been contributed by prominent physicians and others in Michigan, on the general subject of the causation of typhoid fever by contaminated water, has been omitted, in order to confine the paper mainly to the subject of the relation of low water in wells from which water is drank to the causation of typhoid fever. But, although in this paper no attempt is made to give the literature of the general subject of the relation of ground-water to typhoid fever, the author cannot let the paper go without a reference to the work of one whose name is foremost throughout the world in connection with this general subject. I refer to Max von Pettenkofer, of Munich. If I understand Pettenkofer's view, it was in 1869, that with the recession of the ground-water, the air enters deeper into the soil, and stimulates into activity and multiplication disease germs which lay dormant when under water. These germs permeate this ground-air, and whenever the barometric pressure is low, or other conditions favor its upward movement, the germ-laden air rises from the soil and enters houses and causes typhoid fever. That there is a causal relation of low ground-water (not necessarily in wells, but underlying residences), Pettenkofer, from the great masses of statistics with which he dealt, long ago considered established, the chances being as 36,000 to 1. (*Boden und Grundwasser, etc.*, *Pettenkofer*, *Munich*, 1869, pp. 16 and 137.)

The interpretation of the most usual mode of entrance of the cause of typhoid fever into the human body, which pervades this paper, is very different from the interpretation which Prof. Pettenkofer seems to have adopted; yet, so far as relates to the fact of there being a relation of water in wells (ground-water) to typhoid fever, the evidence relative to Michigan is not materially different from the evidence relative to Munich, with which Prof. Pettenkofer dealt, except that it has been found that in Michigan a frozen surface of the ground prevents the low water from causing typhoid fever. Whether or not the interpretation which the author of this paper adopts—that the cause of the fever enters the body most frequently with the drinking-water—will apply to the causation of typhoid fever in Munich at the time the subject was studied by Prof. Pettenkofer, the writer has no ready means of determining, not having at hand a reliable account of the water-supply of Munich during that period of time—1856 to 1869. But in this connection, an account of the enormous reduction of typhoid fever in Munich coincidently with the construction of sewers is interesting and suggestive. In an extract from an address by Capt. Douglas Galton, quoted from "*Proposed Plan for a Sewerage System, etc.*," by Samuel M. Gray, C. E., Providence, R. I., 1884, pages 7 and 8, it is stated that "at Munich the enteric [typhoid] fever mortality per 1,000,000 of inhabitants for quinquennial periods, was as follows:—

"1854 to 1859, when there were absolutely no regulations for keeping the soil clean	24.2
1860 to 1865, when reforms were begun by cementing the sides and bottoms of porous cess-pits	16.8
1866 to 1873, when there was partial sewerage	13.3
1876 to 1880, when the sewerage was complete	8.7"

There was thus, in Munich, coincident with sanitary work, a reduction of two thirds of the mortality from one of the most deadly diseases. Whether this great reduction was due entirely to the work for complete sewerage, or whether that work was wholly or in part incidental, I am not now able to say; but it is reasonable to infer that, during the years 1856 to 1869, when Buhl, Seidel, Pettenkofer, and others were collecting their evidence relative to ground-water and typhoid fever, and when, as appears from what I have just quoted, there was little or no sewerage in Munich, there may not have been as good water-supply as there was after the sewers were complete. If the water-supply was in great part from wells, the evidence which Pettenkofer compiled, together with his statement of probabilities of 36,000 to 1, of the relation of low ground-water to typhoid fever being a causal relation, holds as well in favor of the view that the mode of introduction into the body was with the drinking-water, as in favor of the view that its introduction was with the air inhaled.

At the meeting of the American Medical Association in Detroit in June, 1874, during a discussion in the Public Health section, Dr. Foster Pratt, of Kalamazoo, Michigan, remarked that typhoid fever became unusually prevalent in Kalamazoo in a certain year, in the autumn, about the time the water in the wells became very low, some wells being dry. Dr. Pratt's remarks at that time have had much influence toward the collection, during the past ten years, of facts bearing upon this subject, and toward the preparation of this paper.

H. B. B.

XXV.

SANITATION OF THE MISSISSIPPI VALLEY.

By G. B. THORNTON, M. D.,

PRESIDENT OF MEMPHIS BOARD OF HEALTH, AND MEMBER OF TENNESSEE STATE BOARD OF HEALTH.

This subject is introduced at the present meeting of this association more with the object of awakening an interest in it among sanitarians, and to elicit a discussion on it at this meeting, than with the hope of doing it justice in the time allotted for the preparation of this paper, which was interrupted both by ill-health and business engagements. Presumably there are a number present who reside in this valley, both of the laity and medical profession, engaged in public health affairs, who are conversant with its sanitary defects and needs, and either directly or indirectly interested in all things pertaining to its welfare. Moreover, as the science of civil engineering enters so largely into the discussion of this question, it would afford an opportunity for gentlemen of that profession, members of this body, to give their views on this important subject. No section of country in America of the same extent offers a more interesting field for study to the sanitarian, or greater necessity for practical sanitation, than this; none more worthy of consideration as a question of political economy, involving larger interest as a question for state and national legislation. Take, for example, the vast area known as the Mississippi river bottom, lying between the 37th and 29th parallels of latitude, which would be from Cairo to New Orleans, or to the gulf coast, a distance of 500 miles direct, or about 1,000 miles by river, embracing a territory of 32,000 square miles, which includes, besides many other rich sections, the Yazoo delta of about 4,000,000 acres of alluvium, capable of producing as much corn and cotton, its staple products, as the same area anywhere else in the world. It is estimated that if this delta be completely protected from overflows and brought to its full productive capacity, it would yield about one half the present cotton crop of the cotton states, and corn enough to supply the labor necessary to its cultivation. There are other sections of the Mississippi delta and its tributaries as productive as this at present, only partially opened, heavily timbered, in some places covered by dense canebrakes, the richest of all lands, and interspersed with lakes and bayous as valuable as this, subject to the same obstacles to settlement. These lands are mostly alluvial bottoms, with some few exceptions, subject to annual overflows when not protected by levees, and full of all kinds of insect life incident to a damp, warm atmosphere, a heavy foliage, and dense undergrowth. While there are tracts of this

country open and in a high state of cultivation, with all the necessary comforts of living, many places that were once in cultivation, from force of circumstances have reverted almost to their original wild state, though new lands are constantly being opened, and the whole area in cultivation is now greater than ever before.

This whole country is the true habitat for all malarial diseases,—malarial fevers of every grade, from the ordinary intermittent to the hemorrhagic type, or malarial hæmaturia, as it is commonly called, which are phases of development of a chronic malarial toxæmia, characterized by structural changes of the constituents of the blood, the most difficult to treat successfully, and fatal type of malarial poisoning, and nearly all accompanied with more or less congestion and enlargement of the liver and spleen. A common sequela of this chronic malarial poisoning is an anæmic condition and dropsical effusion. Hepatitis, resulting in hepatic abscess, another sequela of the malarial toxæmia, occurs, perhaps, more frequently here than in any other locality in the country. This is not a metastatic abscess, the result of inflammation or suppuration in some other part of the body, or of traumatic injury or dysentery, which is sometimes associated with hepatic abscess, but a direct result of an abnormal condition of the liver caused as above stated. The pathology and therapeutics of these diseases not coming within the province of this paper, I will not discuss them.

These fevers are endemic throughout this whole section, and other diseases not peculiar to this locality are more or less complicated by the same influences causing them. There is a marked difference in the susceptibility to this malarial influence between the white and negro races. The former is much more susceptible than the latter, and do not stand exposure here so well during the summer and fall months. The negro race seems by nature peculiarly well adapted to this climate, and as a consequence constitute the great mass of the laboring population. In a paper read before this association on "Negro Mortality," in October, 1882, and published in vol. 8 of its transactions, I discuss this subject, and consequently will not dwell upon it now.

Owing to the facilities for transportation afforded by these great water ways, the Mississippi river and its tributaries, which are now supplemented by railroads, through commercial intercourse this valley, as other parts of the country, has been visited several times since its settlement by the two most destructive and dreaded of all exotic or importable diseases,—cholera and yellow fever. Neither has ever found a permanent lodgment in it, to be called into activity by any climatic conditions without fresh importation when once eradicated.

It is through this vast and important country that state medicine or public hygiene may demonstrate its greatest triumphs, and its devotees prove to the world the practical good claimed for it as a part of just state government and advanced civilization. The sanitation of this valley embraces three propositions,—the reduction to the minimum of the causes producing the malarious atmosphere, the improvement in the present

methods of living, thereby increasing the resistive powers of individuals to malaria, and the prevention of the introduction by importation of the infectious diseases above mentioned. The efforts made to prevent the importation of yellow fever along the gulf coast during the past four summers, I think, prove very conclusively that this disease can be kept out of the country by proper care and vigilance.

It has been demonstrated too often to admit of controversy, that large areas, formerly almost uninhabitable, have been so improved by drainage and cultivation as to be not only habitable but highly productive. Surface drainage, though essential through this whole delta, upon the largest scale, does not alone answer for drying the soil and removing the causes of malaria. The process of evaporation from a spongy and absorbent soil is too slow, when such an excess of moisture is to be disposed of during the hot season to prevent the atmosphere from being damp and humid. Much of this dampness can be prevented by lowering the ground-water by a system of underground drainage after the surface-water has been disposed of. Without going beyond our own country, or citing examples from either ancient or modern history, many of which could be given, I will mention the state of Indiana, with which doubtless some present are familiar, as affording a striking illustration of the beneficial results upon the public health of surface and underground drainage of wet and marshy districts. Many localities in that state, where malarial fevers prevailed to such an extent as to retard settlement, have been rendered healthy by thorough drainage for agricultural purposes. It is an open question whether or not extensive overflows cause an increased amount of sickness over those years not marked by such general and long-continued overflows. There is a difference of opinion among those who should be authority on this subject, and no records from which one year may be compared with another, to determine even with approximate accuracy the difference, if any, in the sickness following these extraordinary inundations.

My own opinion is, there is so much swamp land and malaria-producing element throughout this whole bottom country, independent of what are commonly called general overflows, that there is no material difference. Some years are more healthy than others, owing to a difference in atmospheric conditions, independent of their local conditions. For example, the summer of 1878 seemed to be particularly favorable to the spread of yellow fever through the whole valley country, and far beyond any influences of the malarial districts. This disease, that year, as is well known, extended to and spread rapidly through communities along the lines of railroads which were notably healthy, and free from local causes to produce disease. Dr. Stanford E. Chaille, of New Orleans, addressed a circular letter to a number of physicians in Louisiana after the great overflow of 1882, to ascertain if there was any marked increase of sickness in that state attributable to that overflow. His correspondents differed, but there was not sufficient evidence to justify the opinion that there was. He concludes his article as follows:—"In the meantime it

is satisfactory to find that the evidence thus far collected indicates that overflows do not cause, inevitably or generally, any notable increase of malaria, or any other disease, and that they certainly do not usually either cause or promote epidemics. Therefore the direct influence of overflows on health is not usually dreaded." *New Orleans Medical and Surgical Journal*, June, 1883.—Malarial diseases being preëminently the type which prevails most constantly through this whole delta, and which offers the greatest barrier to its development, the local sanitary work required should be such as would prevent or reduce to the minimum the influences causing such diseases.

There are no official statistics outside of a few cities in this valley, and they afford no adequate index to the general health conditions of the bottom country from which to obtain information as to the death rate or comparative loss of labor among the resident white and colored population from these diseases. They prevail mostly at a season of the year, latter part of summer and fall,—a season when the dews are heaviest, and exposure to them, for those whose work in the fields seems unavoidable, is attended with greatest danger. This is a period when labor is in greatest demand to gather the crop and perfect the year's work. The loss to the material wealth and possible resources of the country is not alone to be considered in estimating the death rate, but also in the great loss of time caused by enervating sickness at the most critical period of the year, when the greatest exhibition of endurance is required to resist this malarial poison.

The three conditions essential to the production of this malarial atmosphere are,—heat 67° to 70° Fr., a permament moisture, and vegetable decomposition, or emanations of a like deleterious character from the soil, paludal or marsh miasma; or, as it is more succinctly stated in Wood's Practice of Medicine, heat, moisture, and vegetable decomposition. Remove either element, and, the conditions being disturbed, malaria is not produced. At present these conditions prevail through this whole bottom country, modified or lessened in some localities by improvements, cultivation of the soil, and drainage.

The first essential step towards prophylaxis is to reduce to the minimum the two elements which are to some degree controllable; that is, the moisture and vegetable decomposition, or the miasmatic emanations from the soil. The seasons being immutable, the heat cannot be modified. Civil and sanitary engineering can so dispose of the water distributed over this country by the excessive spring floods and annual rain-fall, as in a measure to control this element. This would require an effective system of levees, canals, and reservoirs for holding back the water from the upper tributaries, and increased rapidity of the outflow of the Mississippi, thereby preventing or diminishing the dangers incident to the more tardy process of evaporation.

The third factor—decayed vegetable matter and the deleterious elements of a fresh soil—is in process of being removed by the constant clearing and cultivation of lands for agricultural purposes. The build-

ing of levees, draining bayous, lakes, and stagnant pools, and removing the deleterious ferments of the soil by cultivation, is a slow process toward the sanitation of this vast delta, though it is being done, and in course of time will no doubt be accomplished.

In the meantime it is well to consider the best methods for the preservation of health in the face of these opposing elements.

The resistance to malaria can be very materially increased by improved methods of living, over the existing methods among the masses of the people, and especially among those unacclimated.

The system can be so fortified as to resist much more effectively the depressing influences of this climate. By these methods are meant all the domestic comforts pertaining to good living. Wholesome food, properly cooked; pure drinking-water, which can only be obtained here by good cisterns; comfortable houses, two stories when practicable, and the upper rooms to be used as sleeping apartments; suitable clothing, a more general use of light flannels next the person, especially by those exposed to dampness; keeping out of the night air and the more malarious localities when the system is most impressible to this atmosphere; a strict observance of temperance in all things, especially abstinence from common whisky, the social beverage of this country. It is reasonable to suppose that a country of the natural fertility of this delta, settled as long as it has been, would be occupied by a population possessed of all the essentials requisite for good living, and observing those rules of individual hygiene best adapted to their surroundings. While there are those who possess all necessary domestic comforts, and observe those habits of life best for the preservation of health, and as a consequence experience as good health as others in more favored localities, this class is exceptional, and only proves the value of local sanitation and proper hygienic observances in individuals. To leave out of consideration this limited class, who may seek more salubrious localities when occasion demands it, it is so generally conceded as to justify the assertion that there are fewer home comforts enjoyed by the mass of the population of this valley than that of any of the same extent and value in the Union. The class of people who seem to me to be the greatest sufferers from climatic or local influence are the white laborers from Northern latitudes, generally Europeans employed by contractors to build railroads and levees through these bottoms. These people are unacclimated; their accommodations for sleeping are of the cheapest and most primitive character—indifferent log cabins or temporary rough board shanties—for convenience' sake located near their work. Their food is of a coarse character, poorly cooked. The drinking-water, one of the greatest essentials to good health, is taken from the bayous or lakes, and is full of organic impurities of themselves sufficient to cause sickness.

Memphis has afforded hospital accommodations for this class of people for years. Numbers of them seek relief there during the latter part of summer and fall, all affected in the same way, with violent remittent or intermittent fevers, sallow complexions, generally with enlarged livers

and spleens, and their symptoms characteristic of intense malarial poisoning, or, as it is commonly called by them, the "swamp fever." I am informed by a large contractor, of many years' experience as a railroad and levee builder in this bottom, that he cannot work to an advantage white labor after the advent of hot weather. Negroes are then the best: they seem by nature to be peculiarly well adapted to this country for all kinds of laboring work. One attack of malarial fever does not afford protection to the system from successive attacks, but there is a degree of acclimation, or the accommodation of the system to these climatic or paludal conditions, which has its value or influence in giving endurance, and affording to some extent powers of resistance. This may be attributable to the natural adaptability and instinctive promptings of man to accommodate himself to his surroundings, whether in an arctic or tropical latitude.

Now that congress has expended five millions of dollars to deepen the mouth of the Mississippi river for commercial purposes and to enable the largest class of ocean-going vessels to come up to New Orleans, and has recently made large appropriations to be expended under direction of its river commission for building levees to protect lands from overflow, as well as other engineering work for the protection of property from the caving of banks, this subject has more than a local interest.

These great annual inundations seem to be getting more formidable and difficult to control every succeeding year than formerly. This is due no doubt to the increased clearing of lands in the country above, which causes a more rapid melting of snows, and increased discharge of all upper rivers after the heavy rains of spring.

Protection from these great inundations is not only of vital importance to those residing and having all their interest in this valley, but becomes in a measure a national question, as no one state is able to cope with it as a whole; but all local sanitary work, such as draining of swamps, bayous, etc., should be done by state, county, and municipal authorities, who should likewise keep a proper record of vital statistics. The Hon. Mr. Ellis, of Louisiana, very justly said, in his speech before the 44th congress on this subject in advocacy of congressional aid for the protection of this delta, "Congress alone has that power."

This great delta is the geographical centre of the agricultural and commercial interests of this country, and, as a pure question of political economy, when protected and brought to a proper standard of public health, preservation by local sanitation will contribute more to the commerce and general wealth of the nation than any other equal extent of country in the Union. The practical question is, What are the best and most speedy methods for accomplishing this great work?

Civil engineers, who are alone competent to decide this, differ very widely on many points, but all seem to agree upon a general system of levees, supplemented by other plans as auxiliary.

Mr. A. G. Warfield, Jr., civil engineer, who accompanied the river commission above alluded to, submitted a report on this subject to the

congressional committee which had it under consideration, which in my judgment is the most exhaustive and able report yet made, and the study of which would repay any one interested in this question. His summary is briefly as follows:

1. Reservoirs at the head waters of the tributaries of the Ohio.
2. Straightening the channel by judiciously located cut-offs.
3. Closing of crevasses and bayous or forced outlets.
4. Erection of levees.

I herewith append tabulated statements from the signal service bureau, showing annual rain-fall and temperature from Cairo to New Orleans. This embraces the whole cotton belt of the Mississippi valley.

ANNUAL RAIN-FALL IN INCHES AND TENTHS.

	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882
Cairo, Ill.	[29.0]	26.5	50.9	48.2	52.9	55.6	39.5	41.8	45.4	49.6	32.2	16.6
Leavenworth, Kansas	[49.0]	47.0	33.0	32.0	31.3	44.5	52.1	35.2	41.6	36.9	40.0	26.0
Ft. Gibson, Indian Ter.	[40.0]	[35.0]	39.3	38.9	44.1	31.5	46.8	13.1	33.1	30.5	37.8	38.0*
Memphis, Tenn.	[59.0]	44.0	56.2	44.1	57.0	55.5	73.5	49.3	52.3	61.7	42.8	71.0
Shreveport, La.	[55.0]	51.0	52.4	54.8	51.0	54.5	47.7	55.8	32.6	66.6	53.7	65.1
Vicksburg, Miss.	[60.0]	58.3	41.2	66.0	70.0	51.7	53.0	60.8	52.3	84.2	51.7	71.6
Fayette, Miss.	[53.0]	[50.0]	[42.0]	44.0	65.8	56.4	72.2	58.5	54.4	72.0	55.4	[68.0]
Brookhaven, Miss.	68.6	57.9	58.9	53.0	73.9	53.4	69.3	63.8	62.0	[75.0]	[66.0]	[70.0]
New Orleans, La.	64.5	64.0	70.0	61.0	85.5	67.2	63.1	66.2	51.3	69.8	64.0	50.2
Galveston, Texas	[42.0]	41.7	58.9	49.6	58.5	50.9	66.9	60.9	26.9	51.0	53.3	57.7
Mean	52.0	47.5	50.3	49.2	59.0	52.1	58.4	50.5	45.2	59.7	49.7	57.9

The above table is from "Signal Service Notes, No. VII," by H. A. Hazen, Computer Office, Chief Signal Officer. Edition 1883.

Records less than twelve months in above table are marked *; interpolated records are marked within brackets, thus: [59.0] for Memphis, 1871.

"The gradual increase of rain-fall during the past three years (1879–1882) is noticeable over a large extent of country, and not merely in a particular section." *Ibid*, p. 4.

D. T. FLANNERY, *Observer in Charge.*

Signal Office, Memphis, Tenn., Oct. 9, 1884.

TABLE I.

Mean Annual Temperatures.

STATIONS.	Year ending September 30.			Year ending June 30.								
	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883
Cairo	57.3	55.7	58.4	56.3	58.3	56.2	61.1	59.1	62.1	70.8	61.5	...
Memphis	62.2	58.5	61.6	60.8	61.6	59.4	62.4	61.3	63.9	71.9	64.5	...
Vicksburg	66.4	64.7	67.5	65.6	66.5	63.7	66.3	65.8	68.1	70.1	68.7	...
New Orleans	68.6	67.6	69.5	69.3	69.5	67.8	69.3	69.0	71.4	70.8	72.0	...

NOTE. Data for Table I taken from Annual Reports Signal Offices.

TABLE II.

Mean Monthly Temperature, being the Means of Ten Years, 1871 to 1880.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cairo	38.8	41.4	48.4	58.3	68.3	75.0	80.0	77.5	69.2	59.1	45.8	38.6
Memphis	42.6	44.9	52.6	60.8	70.5	77.5	81.8	78.8	70.7	60.6	49.0	42.4
Vicksburg	50.0	52.0	59.7	64.6	73.6	79.3	82.1	79.7	74.0	64.1	54.9	50.0
New Orleans . . .	55.8	57.2	63.7	68.3	75.3	80.8	82.6	81.9	78.0	69.3	61.1	55.2

NOTE. Data for Table II taken from Signal Officer's Report, year 1882.

TABLE III.

Mean Rain-Fall in Inches and Hundreds, Period same as Table II.

STATIONS.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cairo	4.47	3.33	4.73	4.34	3.84	4.95	3.68	3.19	2.46	3.22	3.86	3.47
Memphis	5.44	4.59	6.08	7.25	4.13	5.58	3.11	3.64	3.00	3.39	4.48	3.77
Vicksburg	4.27	4.60	7.51	7.90	5.26	4.32	3.54	3.73	4.44	3.00	5.68	5.13
New Orleans . . .	4.30	4.85	6.84	6.35	5.83	5.81	7.53	5.76	5.07	3.39	5.70	4.95

NOTE. Data for Table III taken from Annual Report Chief Signal Officer, 1882.

XXVI.

THE FOOD WE EAT, THE LIQUIDS WE DRINK, AND THE ADULTERATIONS WE SUBMIT TO.

By HON. ERASTUS BROOKS,

MEMBER STATE BOARD OF HEALTH OF NEW YORK.

If men are fearfully and wonderfully made, there is nothing more marvellous in the form of this creation than the character or substance of the food they eat. In this food there is carbon, serving as a fuel for the support of animal life; and carbon, hydrogen, oxygen, and nitrogen make the four essential elements of human life. Phosphorus, sulphur, chlorine, sodium, potassium, calcium, magnesium, iron, and fluorine are but of secondary importance among these primary elements. In all these which the animal and vegetable kingdoms provide, the sustenance of our daily existence is found. They give strength to the limbs, flesh and blood to the frame, and muscle to the whole body.

Carbon, with a little hydrogen and oxygen,—the chief constituents of our food,—compose the alimentary support found in butter, suet, and in all those fatty or oily elements which become part of every healthy life. The flesh, blood, and bones need the phosphates derived from animal and vegetable food. The iron in our blood is obtained chiefly from the meat we eat, and traces of iron are found in milk, eggs, and in almost all kinds of vegetables. The elements I have named are parts of one great whole; and in the food we eat, their mixture is necessary to prevent waste and decay. Using any one of them alone,—which is almost impossible, as the combination is practically a necessity,—the human system would lose about all its forces.

These elements make blood and cause nutrition. There is in them the power of respiration, and there is no real life without them. The saccharine qualities, as water and sugar, the oleaginous, representing butter, the nitrogenous, representing albumen and salts, the aqueous, representing water and other fluids, include and conclude all sources of supply. Water in quantity, if not in variety and quality, holds all these elements. Nine tenths of the milk we use is water. Uncooked beef contains 70 or 80 per cent. of water, and many vegetables have even a larger percentage of fluid; but while this is true, milk is almost the only fluid that supports the human body. This fluid, besides holding water in greater proportions than almost anything else, represents sugar and casein, which, in close alliance with albumen and butter, represent in food what is oleaginous. The proportion of these ingredients in human

milk are ten parts of casein, which makes blood, ten parts of butter or fat, twenty parts of carbo-hydrate or sugar, and a tracing of salt.

For infants and adults alike, physiology has proved in recent experiments that casein and albumen are the essential producers of blood, and we all know what this fluid performs in the work of rebuilding and strengthening the human frame.

The combinations of the several groups of human food are aqueous, saccharine, oleaginous, albuminous, gelatine, and saline. The best recognized teachers of the qualities of food remind us of what is necessary to make up the deficiencies in the wear and tear of life, if we would preserve the necessary fires of animal existence. With constant waste in one direction, the necessary daily food to prevent this decay is required as the needed balance to preserve life.

The "good digestion which waits on appetite" depends largely upon the food we eat. The quantity is oftener far too much than too little, but quality and quantity are essential to the health which almost alone comes from good digestion. Age, sex, habits, uses, and cultivation may regulate the quantity. Any fixed quantity is, therefore, without individual knowledge, almost impossible.

In the army and navy, in the hospitals, and in prisons especially, the quantity is prescribed by pounds and ounces, and the portion is, as it ought to be, based upon the exposure and work done by the consumer. The prison worker usually receives 36 ounces of food, of which whole quantity in England there are 16 ounces of meat during the week. The diet of a single Esquimaux has been given as 35 pounds in 24 hours, and a Siberian Cossack is said to consume from 12 to 20 pounds of animal food daily. Conaro, a famous name in Dietetics, reduced his self-offending corpulence, and lived to the age of 100 in fair health, upon 12 ounces of food, mostly vegetable, and 14 ounces of light wine. State criminals as a rule fare much better than the very poor in private life; and especially is this true in cases where disease is produced by poverty.

THE PROPER COOKING OF FOOD

is one of the fine arts, and men and women engaged in this art are public benefactors so far as they thereby produce physical health. Mental happiness and domestic comfort are largely conditioned upon well cooked food used within the bounds of reason. Without proper limits of quantity the stomach is as much affected by an excess of eating as the brain becomes crazed or addled by intemperance or excess in drinking.

THE ASSIMILATION OF THE FOOD

put into our stomachs is essential to bodily nourishment, and becomes necessary to the avoidance of half the ills which flesh and blood are heir to. How best to secure this nourishment seems from common observation to form one half the work of medical practice.

There can be neither peace nor pleasure where there is bad digestion, and the source of bad digestion is to be chiefly sought in unwholsome food, bad cooking, and the adulteration of what we eat and drink.

There are kinds of food which resist the action both of the stomach and bowels, and even nutritious food may be so prepared as to become indigestible, and positively injurious. The kernels or seeds of currants, gooseberries, melons, and grapes, and the skin of apples and pears, are of the class of indigestible substances; and so also are the skins of wheat, oats, barley, pease, and beans. The teeth may break them, or proper cooking remove them, but without this these substances, which the chemists call *lignin*, are injurious.

Among the birds, these seeds are often swallowed and dropped without digestion; and some of the grandest trees and most beautiful flowers that the eye of man has ever seen are the fruits of the seeds sown where the birds of the air "have winged their way over the earth."

Whatever we may say of the grandeur or æsthetic taste of our drawing-rooms and parlors, and the utilities and uses of our libraries and dining-rooms, the important and essential part of a true domestic home—little as the family may see it, or know of what is done there—is the kitchen. Here, in every well conducted home, is a

PRACTICAL SCHOOL OF ORGANIC CHEMISTRY,

and this kind of chemistry, in the form of skilful or careful cooking, is not only one of the fine arts, but just that one which may give strength to the limbs, proportion and beauty to the form, and vigor to the whole constitution. Here are the means to the end which provide, in the food we eat, the digestion and appetite of all between the ages of the tenderest infancy and the fulness of the most mature life. Here are found what are called both the proximate and the ultimate principles of life and health. Here are the evidences of those four great elements of nourishment already named,—carbon, hydrogen, oxygen, and nitrogen,—and each provided by Providence for the food of man.

The mixture of one or more of these elements is essential to existence, and the use of one of them alone would in time produce waste and decay. These compounds include starch, sugar, gum, and albumen, and make blood, bones, and muscle, and give form, subsistence, and growth to the human body.

The most palatable and beneficial of our varied kinds of food is milk. While its nutritious power is stated at less than one tenth of 1000 parts, it is the best if not the only natural food that seems to support the animal body. There is in it sugar, albumen, casein, and butter, which we usually regard as one of the most welcome parts of our morning and evening meals. Where beef, mutton, veal, chicken, and pork average from one fourth to one third in the 1000 parts of nutriment, and wheat, barley, and oats from three fourths to nearly all, pure milk offers the most natural and healthy food.

Of general adulterations I shall speak very briefly. They are found in a greater or less degree in much that we eat, drink, and wear; and this fact demands, at least, if not for the household at home, for those who provide for the poor and the rich, knowledge both of whom they buy and what they purchase. As a safe rule, in our food and drinks we may banish, except when prescribed by a physician, all our stimulants and all our condiments, with the exception of salt, which is a necessary alimentary principle, and occasionally vinegar when used to soften the texture of our food. None of these stimulants are necessary to health; none of them add to nutrition; and all of them tend rather to weaken than to strengthen the organs of digestion.

FOOD ADULTERATIONS.

The extent of food adulterations is one of the worst signs of the times. No country is free from this public evil, nor hardly any occupation. English food and drug adulterations, as stated on British authority, and chiefly upon the investigations of Dr. Hassall, are so common as to be notorious in their numbers, preparations, and uses. It is next to impossible to reach and punish these abuses; but where it is possible, the attempt at least to reach and punish the crime should not be omitted, nor prove a failure.

New York state and city, and boards of health elsewhere, have investigated and proved the following adulterations:

In *coffee*, so called, where not an ounce of coffee was found in the pound, and where, in other cases, French chalk, gum arabic, charcoal from wood, yellow ochre, and a mixture of clay and hydrate oxide of iron, chrome orange, celestial blue, and tumeric, the powdered root of *curcuma longa*, were found as coloring agents. All these came from one factory alone. In another were found Venetian red, quina, indigo extract, chrome yellow, and orange and Prussian blue, and both of the latter were very common.

The health boards, thanks to the chemists in some of the cities, have succeeded in condemning and removing the Prussian blue and chrome yellow from certain factories; but this whole coloring system is meant as a deception, and is an actual fraud.

Tea. The importation of vicious teas in large quantities has been in part suppressed. But the impure teas thrown upon the market have often been three fourths of the quantity imported.

In *milk*, water is the most innocent of all adulterations, but it is not always pure water. Often barley is fed to the cows, and in some dairies there are pits containing loads of this grain. The milk of cows thus fed in summer is not a healthy food for children, and it is often fed when the barley is fermented and rotten.

Spices are notoriously largely adulterated; and what is called cream ot tarter, the odors in the manufacture of which the N. Y. state and local boards of health have had to suppress by stopping the factories altogether,

at times have had the added offence of cream of tarter sold with 95 parts of gypsum or *terra alba* to 5 parts of tartaric acid.

In milk the adulterations have been even worse than this record. The health office chemist of the District of Columbia has found in Washington a liquid sold there for consumption, under the name of milk, where the substance sold contained not one drop of milk, and was reported as an offensive concoction of the brains of animals.

THE ADULTERATION OF DRUGS,

upon the proper use of which depend health and life, demands the attention of health authorities, and of all in any way interested, commercially or otherwise, in their prescription or use.

IN SPIRITS,

especially in wines, the adulterations are much worse than in coffee or general articles of food. The municipal laboratories of Paris report that almost every kind of eatable food is adulterated; and in a late report the statement is made, that the wine dealers are trying to have the analysis of wine abolished, and some of the Paris deputies, fearing the loss of votes, hesitate even to promise the suppression of the evil. In 1881, upon 3,361 samples of wine examined, 56 per cent. were found bad, and 6 per cent. dangerous. The 6 per cent. marked "dangerous" is about the average of what is beyond the merely bad qualities. What is called antiquated or colored wine, or wine in apparently old bottles, is covered with cobwebs. This is one of the curiosities of the trade.

It is not enough, unless wrong and fraud are to be defended, to say that the adulterations of what we eat and drink are harmless. What is complained of, as proven to the N. Y. State Board of Health is, for example, that hominy burned and ground, or roasted, is sold for coffee, and the same is true of chicory, rye, beans, and other substances. What is called coffee is often wholly without coffee, or without enough of the genuine article in the quantities examined to admit of scientific tests.

BUTTER,

we need not say, should come from the dairy and not from the fat of animals. The fact of adulteration in this article, if ever so harmless, should be known to buyer and consumer.

New York, by statute, has recently forbidden the manufacture of sham butter, forty millions of pounds having been sold in the state in a single year. The constitutionality of this law may be put upon trial, and, if it fail to stand this crucial test, the old evil will continue, and oleomargarine will be sold for butter. But the great wrong consists in calling what is evil good, or what is adulterated pure.

Looking abroad, in Bavaria for example, I see, as recently as in

August, 1883, that at Menningen alone an inspection resulted in the condemnation of 33 breweries, and in fines ranging from \$50 to \$250 each, according to the measure of impurity found. Three other brewers were sentenced to eight months' imprisonment. We need some of these wholesome examples in the United States.

Consumers ought not to be satisfied when spices are sold as pure, of which 112 out of 180 samples have proved impure, though not poisonous. The lowest impurities in these samples were 40 per cent. in nutmegs, 50 per cent. in mace and red pepper, between 70 and 80 per cent. in white pepper, cloves, and allspice, 81.8 per cent in cinnamon, and from 50 to 66.6 per cent. in red pepper, mustard, and ginger. Glucose may be harmless enough, but when 35 and 50 per cent. are mixed with honey and maple and cane sugars, and in several samples of brown sugars from 22 to 33 per cent., the deception is palpable and flagrant. While glucose may make a pure and wholesome food, it must not be sold for an article which is more pure and much more costly.

DRUGS.

Medicinal chemicals are not all adulterated to the extent suggested. Of 317 samples examined by Prof. Chandler and his assistants in New York, only 11 were found to be adulterated or of inferior quality; of 232 samples of vegetable drugs, 85 either did not come up to the required standard, or were plainly adulterated. And of 110 specimens of powdered drugs, such as ipecac, jalap, orris root, rhubarb, and mustard-seed, 46 either in purity or strength failed to meet the required standard. Powdered drugs as a rule have proved the least reliable and satisfactory. This is especially true of short weights in sodas and seidlitz mixtures; and here the fraud is believed to be intentional, and the prescription is necessarily a failure.

DIFFERENT METHODS OF DECEPTION.

The arts and tricks practised by the manufacturer of medicines are almost, if not altogether, equal to the skill of the best chemical and scientific experts. Where inspectors have once discovered intentional deception, as by the use of microscopic examinations, the substance once detected has been removed and other substitutes provided to take the place of what should be wholly genuine. Flour and starch, once detected in powdered medicines, have after this fashion been removed. Experience, skill,—in one word, knowledge,—are required to find out just what is put into powdered medicines which ought not to be there. Real tests should be applied to roots and seeds, like ipecac, jalap, mustard-seed, etc.

OIL FOR CONSUMPTION.

Most kinds of oil are more or less adulterated, and the chief fraud is in calling oil made from cotton-seed, pea-nuts, beech-nuts, poppy, and the ground nut oil of Africa, etc., olive oil. The American cotton-seed, bought at home for three cents a pound, is sent to France and there made into oil, and sent back to the United States and sold for $3 a gallon. The adulteration is common all over Europe and the United States. Cotton-seed oil refined in England is sent in large quantities to Italy for the adulteration of olive oil. Beech-nut oil is largely used in Germany, and, with copper used to give it the required tinge, is sold there and elsewhere as Malaga oil. These adulterated oils are sold in great bulk.

CHEESE ADULTERATIONS.

Cheese in Thuringia and Saxony is adulterated with potatoes or bean meal. The rind has at times in it Venetian red, and at other times blue vitriol and arsenic, to give the cheese the appearance of age. Sometimes nicotine and sulphate of zinc are used to give the cheese a biting flavor, and at times the Limburger cheese is shamefully tampered with. Lard cheese is made at 23 state factories in New York from granted patents, and none, as reported by Prof. Caldwell, is made elsewhere; 6000 lbs. of skimmed milk, 80 lbs. of lard, and 600 lbs. of butter make from five to six hundred pounds of cheese, and 14 per cent., or about 70 lbs. of the whole, is lard. Such cheese is less digestible than when made of milk, and this is also true of oleomargarine butter in comparison with pure dairy butter.

SUGARS

are much less adulterated than formerly. The organic and inorganic dust, dirt, salt, starches, vegetable albumen, terra alba, gypsum, plaster of Paris, once in use, with other and worse ingredients, have, as a rule, passed away, and the adulteration is now limited more to glucose mixed with or added to the refined cane sugar, and the bleaching of brown sugar by the use of tin salts. The dust and dirt, which often enter into the sugars, are the result of either great carelessness or of vicious intentions. Where ultra-marine is used to neutralize the yellow color of the sugars, imparting a bluish white, as was found in 24 of 33 samples, the purpose is not adulteration, and the coloring matter is not injurious.

There are before me authorities showing the extensive and carefully planned adulterations in butter, alum, borax, barium, curd, fats, flour, gypsum, lard, lead carbonate, lead chromate, yellow potato flour, salt, sodium, silicate or soluble glass, soapstone, starch, &c., &c. French, German, and English authorities name all these uses and abuses. Lard or cheap fats are as common adulterations in England as in the United States. Where (see letters of W. A. Croffert) loads of sacks filled with

pease and beans are ground and sold for coffee, and the sweepings of factories are used to adulterate ginger, two thirds are impure to one third of the pure article retained. Old boots and shoes literally pass through the heat of the hottest ovens to be mixed with pepper, and old tannin, removed as a nuisance, is ground into cinnamon. This class of domestic manufactures simply forbids all additional comment upon what at times is thus made and sold.

Finally, there is no more reason in truth, and there is much less reason in fact, why food adulterations should be more tolerated or excused than adulterations in gold or silver, or the use of counterfeit money in coin of any kind. What is sold as food to eat, or as coffee, tea, cocoa, beer, or wine, or more stimulating spirits, for drink, should be pure. The gold, when adulterated for purposes of science or manufactures, should state the grains of pure gold in the coin or in the article made, whether in jewels or any other thing manufactured. The same at least should be true of the silver dollar coined at the mint, and of every article of silver. Even more should this be true of what we eat and drink.

I am not surprised, however, to hear the federal government cited as a successful example of adulterated money, by those who practise the manufacture and sale of tainted and adulterated food and drugs. We cannot always control the government, but we can at least insist that the manufacture and sale of adulterated food and medicines shall be exposed to the public eye and punished by public law.

XXVII.

ADULTERATION OF FOOD AND DRUGS.

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The subject of adulteration in food and drugs, although always of great importance, has become of still greater consequence in these days of ever increasing sharpness of competition in trade. Very fortunate it is that such a large proportion of those prevalent in food affect more our pockets than they do our health, being rather either fraudulent or accidental than deleterious. In the case of drugs or medicines, however, all sophistications must be considered as deleterious or injurious to health.

Among the articles of food much subject to adulteration, that of milk is by far of the greatest importance, for it forms the only or the principal article of food consumed by a large portion of our infant population during those years when they are least able to withstand any tampering with their nourishment. Besides, it is one of the most important articles of food entering into the daily use of almost all other persons. This is an article of which the adulteration is most easy of execution, and which can be carried to a considerable degree without much liability of detection by the ordinary consumer.

The removal of cream and the addition of water are not of consequence simply as diminishing the amount of nutriment contained in any given quantity of milk, but they affect the digestibility of that which remains. The reduction in the amount of the fat or cream present in a skim-milk results in the formation of a tougher and coarser curd, and it is thus more unlike the fine soft curd which forms in the stomach of a child which has fed upon its mother's richer mik. These differ about as much in digestibility as would a skim-milk cheese swallowed in large pieces from a cream cheese which had been finely masticated. Then, too, the water added, having for the most part to be used upon the sly, is not likely to be of as good a quality as it would be if it were added more openly. Even this last, as common good water is never absolutely pure, will, on being added to milk about a dozen hours before it is to be used, and the milk in the meantime being much shaken up by being carted about town, start such a change in a milk as will prevent its keeping sweet so long as it would if water had not been added, although all other circumstances remained the same. Furthermore, it is a well known fact that milk not yet turned, but which is just upon the point of turning, and

which it will immediately do upon being taken into a child's stomach, will create a greater disturbance in digestion than if it had been taken already absolutely turned sour. Thus the common adulterations of this article of food result in a double injury.

How to obtain a good supply of pure milk for a large city is a problem presenting considerable difficulty for its solution. A well framed law, vigorously and impartially enforced by an inspector well backed by public opinion, and who has greater interest in his task than any salary can give, may accomplish it as nearly as practicable, but it requires means proportionate to the great importance of the ends to be attained. The law must grant ample rights of inspection,—that is, of access to and of taking of samples. The activity of inspection must be such as to make the chances of detection almost certain, and the punishment therefor must follow surely and speedily. The most effectual form of punishment thus far devised would seem to be that of publication in the local journals, whereby a greater penalty is inflicted through loss of trade than could well otherwise be imposed. For ease of conviction in cases of adulteration, a fixed minimum limit of variability in salable milk is of the greatest importance. This, in the interest of the public health, should be drawn, not at the poorest milk ever known to have been obtained from a healthy cow, but it should be at the limit of a fairly good whole milk, which, in the state of Massachusetts, is fixed at 13 per cent. of milk solids. Of these, not less than 3 per cent. should be fat. The average milk of common dairies in Massachusetts has been found to contain about 13.75 per cent. of milk solids.

In large cities, such as Boston, where there is a large demand for cream for use in coffee, etc., the topping of milk is the most common form of adulteration. The major part of the milk sold in stores was being thus treated when I first began to take charge of the milk of that city.

The simplest method of inspection of market milk, with some reasonable degree of accuracy, with which I am acquainted, is by taking its specific gravity by a float, and percentage of fat by the optical test of Feser's lactoscope. This requires only about three minutes' time. Whole cow's milk at the temperature of 60° F. will be found to have a specific gravity of 1.029 to 1.033, and to have not less than 3 per cent. of fat by Feser's test. The limits of specific gravity will be raised .001 by a reduction of 10° F. in the temperature. A simply skimmed milk will have its specific gravity raised above these limits, while its fat will be considerably decreased. A simply watered unskimmed milk will have a specific gravity under 1.030, with a fat percentage somewhat under 3. If the specific gravity and the fat are both much under this, it has been skimmed as well as watered. If, however, the specific gravity is about 1.033, or a little over, while the fat is much decreased, but, however, after this milk has been skimmed, the specific gravity is then that of skim-milk, then it is a whole milk mixed with skim-milk. This is the method of examination which I recommend to milk-dealers and con-

sumers, for their own use. The fat test will not vary more than one fourth per cent. from the true weight in a whole milk, or more than one half per cent. in a skim-milk.

For chemists in their laboratories, a modification of the Wanklyn method is what I find is most advantageous. My modification in brief is, to evaporate the 5 grm. of milk in its flat-bottom platinum capsule in the free air upon the top of a water bath, completing it in a paraffine oven at the temperature of 105° C.; to determine the fat by its removal, by thrice boiling up the total solids in its capsule, while set again upon the copper oven with separate portions of a light petroleum naphtha, decanting off the naphtha, and finally washing off the capsule with the naphtha from a wash-bottle. This material being so cheap it can be used very freely; and, moreover, it has another advantage over ether, that of not dissolving out any of the sugar. With the facilities of my laboratory, determining the sugar by the polariscope, each assistant can make a full analysis of over twenty samples of milk in eight working hours, so that by excluding all undoubted good samples of milk, as determined through their specific gravity and percentage of fat, and analyzing only the others, one person can examine a large number of samples of milk per day. The full details of my modification will be found in my report in 1885, to the city of Boston as milk inspector, and these are of importance if very great rapidity of execution is demanded.

For any efficient inspection, every dealer in milk of a city ought to have a sample of his milk examined at the least as often as once a month.

In Boston there are some three thousand dealers, of whom about seven hundred are on milk-wagon routes. Some thirty-six thousand of eight and a half quart cans of milk are sold in the city upon an average daily, that is, to the value of about $5,250,000 a year, at the price of 40 cents per can.

Massachusetts is, I believe, the only state of our Union which has a special vinegar act. Ours is a very simple one, which, besides requiring a vinegar to be really of the kind for which it is sold, also requires that it shall have an acidity equivalent to the presence of not less than five per cent. of absolute acetic acid in weight, and that cider vinegar shall have a solid residue of not less than one and a half per cent. of cider vinegar solids. This cider vinegar solid in the pure article is so free from soda as not to give any yellow tinge to the Bunsen gas-lamp flame when it is ignited in it. The reaction of this ignited residue upon turmeric paper furnishes the simplest manner of detecting the presence of the slightest amount of any free mineral acid in the vinegar. If there be any, it cannot give the brown alkaline stain, and if there be any arsenic present from a glucose made by sulphuric acid derived from pyrites, as the last spark glows through the carbonized mass the familiar garlic oder can be easily perceived. The percentage of acidity can be most easily determined by taking 6 grms., or in a commercial way 6 c. c. of vinegar, diluting it sufficiently with water to make it about white, adding a few drops of an alcholic solution of pheno-phthalein, and then running into it from a

burette a normal solution of soda until the pink color of the neutral point is reached. The number of cubic centimeters of soda solution consumed is the percentage of acidity of the vinegar. A pure cider vinegar gives only the slightest perceptible reaction for sulphates by barium, for chlorides by silver, or for lime by oxalate of ammonium. If more than this, it is not a pure article, while it should give a good precipitate for malic acid, with a solution of subacetate of lead.

The examination for adulteration in drugs for the state of Massachusetts is conducted under an excellent statute based upon a draft for an act drawn by the National Board of Trade, after the prize essay of G. W. Wigner, of London. Under this act, according to the rulings of our courts, the last revision of the United States Pharmacopœia is the standard for all the drugs and preparations mentioned therein.

During my first year's work for our state board of health, I examined about three hundred samples of pharmacopœial drugs, and of them I found that about 40 per cent. did not conform to its requirements. The drugs examined were principally such as were of the greatest importance as medicines, such as had been reported in recent pharmaceutical literature as wanting in strength, quality, or purity, and such as contained some costly ingredient, the omission or diminution in the quantity of which would greatly increase the profit of sales, and which, from the difficulties of its detection, would be likely to pass unchallenged.

Naturally, in such a list the numeous preparations of opium and of cinchona bark formed a very important part. Of opium preparations, that of the tincture is probably the most frequently used. Of this tincture I examined one hundred samples. Of these, four only exceeded the maximum allowable strength of 1.60 per cent. morphine, according to the 1880 revision of the United States Pharmacopœia; while 82 fell below the minimum allowed of 1.20 per cent., 43 only fell below about .90 per cent. morphine, which, according to the revision of 1880, was the quantity required by the revision of 1870, and its method of assay. Their average strength was .965 per cent. morphine, the extremes being .336 and 1.87 per cent.

In specific gravity they varied from .921 to .997, with a mean of .953. This preparation is a striking example of the very great need of an enforced uniform standard. There was one sample of this very important and powerful drug very nearly six times as strong as another, to the great danger of the health and even the life of the public, about equally from the danger of either want of action or over-action. In a case of emergency, the too weak sample being the one used, the patient might die for want of the proper action; or, if a patient or physician, having become accustomed to the largely increased size of dose necessary with the weaker preparation, afterward takes or gives the stronger preparation in the same dose, again fatal results may happen from over-action. Thus from either cause the patient may die. There is a much greater apparent than real change in the strength of the laudanum made according to the 1880 revision of the United States Pharmacopœia over that of 1870.

An opium that will give the 12 per cent. morphine required by the 1880 process of assay will just about give the 10 per cent. by the 1870 process, if it be conducted in the most favorable manner; so that the maximum required strength of powdered opium remains the same. In the tincture, however, there has been made the change from the about 9 per cent. opium of the revision of 1870 to the exact 10 per cent. of the revision of 1880; that is, the revision of 1870 is about one tenth weaker in opium than that of 1880.

The proper method of assay of the tincture of opii, under the revision of 1880, is to take 70 grms. of it and evaporate it to dryness at not above 85° C. as directed under powdered opium, and then to proceed exactly as directed for opium itself. The resulting weight in grammes multiplied by two gives the per cent. of morphine strength. This process of assay for opium is part of the required standard, which is that the opium should contain not less than the 12 per cent. by the given method, while the absolute contents are not mentioned at all. The about 50 samples of powdered opium which I examined yielded on an average 13.34 per cent. morphine, even although several of them had evidently by intention been reduced by the addition of milk-sugar down to about the minimum allowable strength of 12 per cent. Only one of them exceeded the maximum of 16 per cent., and none, except the evidently reduced, fell below 12 per cent.

Next most important to the opium preparations, if they do not even excel them, are the preparations from cinchona bark. Of the simple cinchona alkaloid salts which I examined, about 25 per cent. of them contained an excess of the cheaper alkaloids. There was no case of total substitution, however. Of the citrate of iron and quinine, out of 40 samples, 33, or 82.5 per cent., fell below their proper weight of 12 per cent. quinine. One contained even as little as one half of one per cent. The deficiencies were all of quantity rather than of quality of the quinine.

All the ready-made coated quinine pills of the Boston market have been examined. The best method to employ for the assay of quinine pills is to take say ten two-grain pills, dissolve them in a little water in a small capsule, breaking up with the aid of a small glass rod, add excess of caustic lime, and dry thoroughly at 100° C. Remove the dry mass and powder very finely, and transfer to a tube for continuous percolation with strong ether of the United States Pharmacopœia. Although all alkaloids were practically extracted in six hours, I continued it for forty-eight. Then evaporate the ethereal extract obtained, after transferring to a beaker to dryness at 100° C., and weigh the residue. It is needless to say that in these two transfers the utmost care should be taken that no material be lost, and therefore that the capsule, mortar, and extraction flask be thoroughly rinsed out with ether till no bitterness remains in them. The ratio of the anhydrous alkaloid obtained to what 20 grains of sulphate of quinine, even with the 8 molecules of water allowed by the United States Pharmacopœia, should have yielded, gives the weight of quinine which the pill may have contained. This alkaloid

should then be submitted to the United States Pharmacopœia test of quinine for identity and quality. This last is the Kerner's test for the presence of the cheaper cinchona alkaloids. It excludes more than 1 per cent. of quinidine or cinchonidine, or more than a trace of cinchona.

About two hundred samples of powdered pharmacopœial drugs were examined microscopically, and about 20 per cent. were found to contain foreign ingredient, or, rather, appeared so, for it is not common now as formerly that totally foreign substances are introduced, but it is the closely allied and inferior varieties, or damaged samples and trimmings of the very same drug, that are used. Millers now study structural botany, and are becoming as expert as those whose duty it is to expose their improper practices. They have the excuse of the too well known fact, that many druggists require as many pounds of the powdered drug to be returned from the mill as were sent, refusing to allow anything, or the proper amount, for the well known inevitable loss incident to the necessary drying and subsequent powdering of the drug. And they say that in returning as much as was sent no deceit is practised, for every one must know that something must have been added to make up for the loss incident to the powdering. The consuming public, however, are none the less deceived, although the trader may not have been.

The duty of examining food and drugs for adulteration has given rise to a new profession,—that of public analysts or sanitary chemists. It would be very advantageous if they were united here in America into some sort of an association equivalent to the Society of Public Analysts in Great Britain, to which some of us have the privilege of belonging. It is only by uniformity of process that we can obtain results which are justly comparable with each other. It would add greatly to the public estimation of the calling if all the analysts could agree in their results when reporting upon the same article.

XXVIII.

THE USE OF COTTON-SEED OIL AS FOOD, AND FOR MEDICINAL PURPOSES.

By Prof. CHARLES E. MUNROE, U. S. N. A.

For some years past it has been claimed that much of the oil sold in the market as olive oil consisted wholly or in part of cotton-seed oil, and it is even asserted that considerable cotton-seed oil is shipped in bulk to the olive oil producing countries, to be there put in olive oil packages and reshipped as such to this country. No doubt this assertion has been based upon knowledge, but as yet I am unaware that any analytical or other evidence of its truth has been produced; yet the close resemblance of the oils, and the greater cheapness of the cotton-seed, render the sophistication easy and profitable, and hence quite probable. One reason for this lack of positive evidence has undoubtedly been due to the fact that no reliable method for the detection of the cotton-seed oil has been known.

Some time since my attention was called to this oil and its uses, and I was led to the study of its physical and chemical properties and of those of the oils with which it is commonly supposed to be mixed or for which it is substituted, with the hope of obtaining some accurate means for detecting it in the presence of these other oils. Among the other properties studied was that of the heat evolved through the reaction of the oils with sulphuric acid. This property was pointed out by Maumené in the *Comptes Rendus* **35**, 572—1852; and he describes his method of procedure as follows:

The fat acids when mixed with sulphuric acid disengage heat, and this action serves to distinguish them, and in a measure to separate the drying from the non-drying oils. For analysis, put 50 grams of olive oil in an ordinary beaker glass, plunge a thermometer into the liquid, and carefully add 10 cm. of sulphuric acid of 66° B. Stir the mixture with the thermometer, and watch the rise in temperature. If we start with the oil and acid at 25° C., the temperature is raised to 67°, an increase of 42°. The mercury does not rise for more than two minutes, and it is necessary only to mark the maximum temperature.

In a similar vessel put 50 grams of the oil of poppy, and treat with the acid. Starting from 26° the thermometer rises to 100.5°, an increase of 74.5°. We remark in this case (1) a very marked development of sulphur dioxide, which is not produced with the olive oil; (2) a considerable swelling of the liquid. On account of these two circumstances the

number 74.5° is too small. The difference of 42° to 74.5° is enough, however, to offer a means of analysis.

Fehling has taken advantage of the same reaction, using but 15 grams of the oil. Alexander and Morfit, in their *Report on Oils to the U. S. Light-House Board*, page 50, 1855, have also adopted the method and commend it highly, but they used two volumes of the oil to one of the acid. Thurston, however, in his *Friction and Lubrication*, page 80, 1879, after citing the results of Maumené and Fehling for a large number of oils, says, "It seems evident that this method is either not at all accurate, or was not well practised by one or the other of these investigators;" and it is probable that this opinion has been the prevalent one, since the method seems to have fallen into disuse.

On trial of the method, as proposed, I found it was by no means an easy matter to obtain concordant results, or to explain the reason for the failure; yet, in spite of this fact and of the adverse criticism cited above, I was convinced that the method was sound in theory, and the success attending the many recent experimental investigations in thermo-chemistry encouraged me in the belief that it could be put in practice. After several hundred experiments, in which many variations were made in the conditions, I at last found it possible to perform the analytical operation with ease, celerity, and accuracy, and to obtain not only concordant results with the same oil, but to be able to measure the percentage of each oil in a mixture.

At this stage our president suggested that I should employ the process for examining the oils offered in the market for sale for food and medicine; and I have done so in several instances, the oils examined being given in the following table, and the results of the analyses in the second table.

TABLE I.

Descriptive List of Oils Examined.

Analytical Number.	Name of Oil.	Form of Package.	Size in fluid ounces.	Price.
1	Specialita Vero Olio d'Oliva di Lucca Francesconi	Can.		
2	Huile d'Olive Superfine, Doublement Clarifiée, R. Courtney & Brother, Baltimore. .	Bottle, capped.	16	90 cts.
3	Huile d'Olive, Vierge d'Aix, Alexis Godillot, jeune	do.	6	30 "
4	Huile d'Olive, Vierge d'Aix, Alexdre Eyqueme	do.	6	25 "
5	Extra Superfine Italian Salad Oil, Antoinne & Co., Leghorn	do.	6	20 "
6	Huile d'Olive, de Passel Fils, Marseille, Surfine Raffine	Bottle, with thin foil.	8	
7	B. Dufour & Cie., Bordeaux, Huile d'Olive, Surfine Clarifiée	do.	4	15 "
8	Huile d'Olive, Vierge, E. Cartoux, Nice. . .	do.	4	12 "

TABLE I—continued.

Analytical Number.	Name of Oil.	Form of Package.	Size in fluid ounces.	Price.
9	Huile d' Olive, Surfine Clarifiée, Bordeaux .	Bottle with thin foil.	4	12 cts.
10	Huile d' Olive, Vierge, E. Louben, Nice. . .	do.	4	10 "
11	Sweet Oil, Gilbert Bros. & Co.	Bottle, without foil.	2	10 "
12	Winter yellow cotton-seed oil			
13	Winter strained cotton-seed oil			
14	Summer yellow cotton-seed oil			

TABLE II.

Results of Analyses.

Number.	Initial Temp.	Final Temp.	Time of Reaction.	Number.	Initial Temp.	Final Temp.	Time of Reaction.
1	29.1°	66.°	2′ 40″	9	28.2°	80.5°	1′ 00″
2	28.2°	64.5°	2′ 08″	10	29.3°	82.7°	1′ 10″
2	28.3°	64.6°	2′ 20″	11	28.2°	80.7°	1′ 07″
3	28.°	64.°	2′ 12″	12	29.5°	81.5°	1′ 30″
4	29.3°	67.5°	2′ 08″	12	28.°	80.4°	1′ 15″
5	29.6°	66.5°	2′ 35″	13	29.1°	82.8°	55″
6	28.3°	65.5°	2′ 00″	14	28.°	80.°	1′ 05″
7	29.4°	81.5°	1′ 00″	14	28·7°	80.7°	1′ 20″
8	29.2°	81.5°	1′ 30″				

On inspection of this table, it will be observed that numbers 12, 13, and 14 are added for purposes of comparison, and that the oils are divided by the *final temperatures* into two well marked groups,—those from 1 to 6 inclusive, and those from 7 to 11 inclusive. The oils were taken at random, as purchased in the shops; but the latter group forms nearly 46 per cent. of the whole number examined, and gives practically the same results as the cotton-seed in 12, 13, and 14, both as to final temperature and to the time of the reaction. They also agree in yielding large amounts of sulphur dioxide toward the completion of the reaction, and in forming a similar body when mixed with water. This last property is apparent to the eye but is difficult of description, and seems to be due to the formation of a sulpho compound, which I intend to subject to further investigation.

In thus pointing out, with considerable certainty, the fact that cotton-seed oil is sold in the market as olive oil, I do not wish to be committed to any opinion as to its wholesomeness in use. I speak thus directly because I find that on account of my paper on the *Action of Vegetable*

Acids on Tin, which I had the honor of presenting to you in 1879, I have been included among those who are opposed to the use of tinned vessels for the preservation of food, notwithstanding that I stated there that I only presented a few observations which had come within my experience, and that I considered the investigation incomplete.

This question of wholesomeness is, however, an important one, and one which is worthy of investigation by this association, and, considering the probable widespread use of cotton-seed oil under other names, it is one for whose solution the evidence can readily be reached. If its wholesomeness can be shown, it is of importance that this association should do so, for it seems to me that we should not be content, as we have been in the past, with pointing out only the dangers with which life is environed, but we should also lead to those places of safety whose existence is not known, or whose value is questioned.

Among recognized hygienic facts, there is probably none better established than that much of the disease and misery among the poor is due to the lack of variety and insufficiency in amount in their food; and yet we find that a greater part of the sophistication which prevails is practised upon them. In the example under discussion, it is seen, by reference to table I, that the sophistication is confined to the smaller packages, which are sold for small amounts, and are thus within the reach of people of limited means. If now we convert these prices into prices per gallon, we find that they vary from $1.92 to $3.20 per gallon. In the following table, compiled from the *Oil, Paint, and Drug Reporter Year-Book* for 1883, I give the average prices of cotton-seed oil for ten years.

Comparative Production and Average Price of Cotton-Seed Oil.

Production.		Price per Gallon.		
Years.	Gallons.	Crude.	Summer yellow.	Winter yellow.
1870–'71	2,910,593			
1871–'72	2,263,083			
1872–'73	2,304,970	44⅔	51½	60¾
1873–'74	2,934,720	46⅜	53	60⅔
1874–'75	3,450,000	47½	56½	64½
1875–'76	5,242,500	46	54¼	59
1876–'77	4,504,000	43⅔	49½	53⅔
1877–'78	6,687,208	42½	50⅚	54⅓
1878–'79	7,800,000	35⅜	42⅔	49⅝
1876–'80	10,000,000	36⅜	44⅓	51½
1880–'81	8,093,298	34⅔	43⅛	53
1881–'82		44	51½	57
Average Price, 1872–'82,		42⅞	50½	56⅔

Inspection and comparison show the enormous profits which this trade with the poor brings. If we could but show that cotton-seed oil were wholesome, and by our action remove the prejudice which this, like each new food-product, meets with when sold in the market under its own name, we would add another article to our recognized dietary, which is a natural home product, and whose cheapness seems fairly well assured.

XXIX.

POISONOUS OR "SICK" CHEESE.

By V. C. VAUGHAN, M. D.,
Ann Arbor, Mich.

It is well known that cases of severe illness follow the eating of some cheese. Indeed, such instances have been observed in various parts of the world for the past three hundred years. They are of frequent occurrence in the North German countries and in the United States. In England they are less frequently observed, while in France, where much cheese is used, we find no record of any such cases. In northern Ohio, a few years ago, the reputation of a large cheese factory is said to have been destroyed by the great number of cases of alarming illness occurring among those who ate of its product. In Michigan, during the past six months, nearly three hundred cases of cheese-poisoning have been reported.

It will be seen from the above statements that this subject is of sufficient importance to demand the attention of those interested in public health. The object of this paper is to present to you, as briefly as possible, the results of some practical studies upon cheese which has proved poisonous to many; and I hope to receive from some of the many eminent sanitarians among you additional information of value. I desire that it should be distinctly understood that I do not regard my work upon this subject as completed; indeed, I offer this paper simply as a preliminary report, and hope that time and opportunity for further work in this direction will be mine. In this paper I shall be guarded in my statements, and shall endeavor to draw no conclusions which are not thoroughly warranted by the experiments, as I believe it to be more in accord with the true scientific spirit to draw no conclusions at all, rather than to come to those which more thorough experimentation shall show to be erroneous.

The symptoms produced by "sick" cheese, as reported by German and American physicians, agree quite closely, and are as follows: Dryness of the throat, nausea vomiting, diarrhœa, nervous prostration, headache, and sometimes double vision. In short, the symptoms are those of a gastro-intestinal irritant, with marked secondary effects upon the nervous system. Notwithstanding the alarming symptoms, recovery follows. I have failed to find any record of a case terminating fatally. It is true, Hiller states that the cases generally end favorably, which would leave us to infer that they sometimes do not so terminate. His exact

words are,—"Trotz der tiefen Prostratio virium, in welche derartige kranke gewöhnlich verfallen, endet die Krankheit doch meistens in Genesung."

The symptoms of cheese-poisoning, and those of sausage- and fish-poisoning, are very similar, though death from eating poisonous sausage and fish frequently occurs in Germany and Russia. Böhm reports the mortality from sausage-poisoning in Germany as from 23.2 to 54.2 per cent., while Müller reports only six deaths in 343 cases occurring in Holland in 1874, a mortality of less than 2 per cent. The mortality from fish-poisoning among the natives along the Volga is reported as high, but exact figures are wanting. From the studies of Sengbursh, Owsjaunikoff, and Berkowsky, it is evident that the toxic agent in the fish used along the Volga arises from partial decomposition. The fish consist of three species of the genius accipenser (A. sturio, A. huso, and A. ruthenus). For preservation, they are cut into pieces, salted, and buried in wooden casks in the earth. As needed, they are taken up and eaten raw. Likewise Kerner, Paulus, Schlosser, Niedner, and Müller, from special studies of sausage-poisoning, conclude that the toxic material is due to partial decomposition. I mention these facts in regard to poisonous sausage and fish for the reason that they may throw some light upon our study of poisonous cheese.

Böhm and several others state that cheese which has proved harmful to man may be eaten by the lower animals with impunity. In order to test this I kept a cat in confinement for seven days, and furnished it only water and cheese from a cake which had poisoned some 30 or more persons. The cat fed upon the cheese freely, and at the expiration of the time seemed in excellent health. The animal was then killed, and a careful post mortem examination failed to reveal any lesion. There was not even the slightest evidence of irritation of the stomach. As this experiment so unquestionably confirmed the reports of other experimenters, I deemed it unnecessary to repeat it, and concluded that on cats at least poisonous cheese produces no injurious effects.

During the past summer frequent reports of cases of poisoning from cheese were sent to the Michigan State Board of Health, and the matter was referred to the writer for investigation. It was found that the cheese causing the trouble was all made at the same factory. I visited the place, and was furnished with every facility for studying the process of manufacture, and for examining the agents used, and the vats.

The milk is brought in every morning by the farmers of the neighborhood, is poured into a large tin receiver, and from thence is emptied into the vats. The milk brought by different persons is mixed, and this milk is used for filling each of the vats, three in number.

The rennets are also prepared by the farmers. This is done by emptying the stomachs, scraping off the mucous membrane, filling with salt, and drying. The rennets thus prepared, and found on hand at the time of my visit, were examined, and found to be free from any sign of decomposition. The same rennet was used in each of the three vats. If it be true,

as Mr. Horton, the manufacturer, thinks, that all the poisonous cheese came from one vat, the rennet cannot be the carrier of the toxic substance.

The cheese is colored with annatto, which was examined, and found to be free from harmful adulteration. Moreover, the same stock of this coloring agent was used in making the cheese which had proved poisonous and that which had proved harmless. From these facts it is evident that we can not charge the deleterious effects of certain cakes of the cheese to this ingredient. Coloring cheese with annatto has been so long practised, and the public demand for this tint is so well established, that it may be regarded, I suppose, by the manufacturer as a justifiable adulteration.

The vats are lined with tin, and kept scrupulously clean. They are heated by steam pipes placed underneath. Each vat furnishes curd for seven or eight cheeses.

The curd is cut, placed in cheese-cloth, and subjected to screw pressure in iron hoops, the expressed fluid finding free exit beneath.

The curing-room is large and well ventilated. In this, cheese are placed on shelves and left for fourteen days or longer, when they are placed on the market.

The manufacturer states that all the cakes which proved poisonous were made between April 26 and May 6, 1884.

Five samples of the cheese which had proved harmful were examined. They were found to be similar in every respect. From the fresh cut surface there exuded drops of a watery, slightly opalescent fluid, which was found instantly and intensely to redden blue litmus paper. If a small piece was dried thoroughly by prolonged exposure to the air, and then moistened with distilled water, the water would give the same intense and immediate acid reaction. Thorough tests for mineral poisons and vegetable alkaloids and glucosides were negative in their results.

I covered some bits of the cheese with 90 per cent. alcohol, agitated thoroughly, and filtered. The clear alcoholic filtrate, on being evaporated at a low temperature, left a large residue of fatty acids with possibly some contained nitrogenous bases. Having ascertained that nothing could be learned by feeding the cheese to the lower animals, I determined to experiment upon myself. I ate a piece of this alcoholic extract, about the size of a hazel-nut. It had a bitter, acrid taste, and in ten or fifteen minutes there were marked constriction and dryness of the fauces, much the same as that experienced while under the effect of atropia. Later there was considerable nausea, and I could readily believe that a larger amount would have caused vomiting. This experiment was repeated a number of times with the same result, and from it I conclude that the poisonous material, whatever it may be, is contained in the alcoholic extract. This would indicate a chemical poison and not a bacteric one. However, this chemical poison might be generated by the agency of bacteria. What were the chemical constituents of this extract? It contained several fatty acids, some with a melting point as low as 14° C., or lower, and some

with a melting point as high as 43 C. Chemists know how difficult it is to separate and identify these fatty acids, and will therefore pardon me for not naming them with certainty. There is also a probability that the alcoholic extract contains one or more nitrogenous bases. I say a probability, because all students of putrefaction agree that there is a nitrogenous substance which produces many of the symptoms caused by atropia.

Microscopical examination of the opalescent drops already mentioned, or of water which had been poured upon the cheese and allowed to stand for a short time, revealed bacterium termo and spherical bodies from ¾ to 1 micromillimeter in diameter, the latter having a rapid swinging motion. These spherical bodies are not the ova of small animals, for they are insoluble in ammonium hydrate. They may be microcci, or the resting spores of some bacillus.

A bit of the cheese was placed in a neutral sterilized fluid, and, with another portion of the same fluid for comparison, was allowed to stand for two or three days. At the expiration of this time both specimens were examined. The fluid containing the bit of cheese was found intensely acid: the other still neutral. The former contained bacterium termo and a bacillus. This was evidently bacillus subtillis, or bacillus butyricus. I find that the distinction, if indeed there be any, is not made clear by bacterogists. Cohn and Pasteur, if I understand them correctly, think that bacillus subtillis is the agent concerned in butyric acid fermentation, and in the ripening of cheese, while Klein distinguishes between bacillus subtillis and bacillus butyricus. I conclude that the spherical bodies before mentioned are the resting spores of this bacillus.

Some of this fluid, in which the bacteria had developed, was injected under the skin of a cat, and after four days, the animal remaining apparently unaffected, it was killed, and section failed to show any abnormality.

Many samples of harmless cheese were examined in the same manner as the poisonous. The yield of fatty acid in the alcoholic extract was not great, and although the same micro-organisms were present, they were not found so abundantly. The microscope used in these studies was a Gundlach ⅛ in. objective.

The above is a brief account of the observations and studies made. Can we draw any practical conclusions from them? In the first place, as to acid reaction of bad cheese, I have tested with litmus a great many samples of harmless cheese, and find that while all new cheese feebly and slowly reddens litmus, only the poisonous cakes give the intense and instantaneous acid reaction. Of course, the old, foul-smelling cheese, such as Limburger and Schweitzer, are alkaline in reaction; and poisoning never results from their use. I think that it can be positively stated that any cheese which will instantly and intensely redden blue litmus paper should not be eaten. This is a test easy of application, and every grocer on cutting a fresh cheese should make it. If the cheese is dry, a bit of it should be moistened with water, and the litmus paper then applied.

In the second place the following propositions, subject to modification by future work, may be given:

(1) The toxic material in poisonous cheese is a chemical compound soluble in alcohol.

(2) The production of this poisonous material is due to the rapid growth of some bacterium.

(3) The difference between poisonous and non-poisonous new cheese is one of degree rather than of nature.

Why these bacteria should develop more rapidly in some cheese than others, and how this is to be prevented are questions which the writer hopes to investigate, under the direction of the Michigan State Board of Health.

XXX.

THE MILK-SUPPLY OF OUR LARGE CITIES: THE EXTENT OF ADULTERATION AND ITS CONSEQUENCES: METHODS OF PREVENTION.

By J. CHESTON MORRIS, M.D.,
Philadelphia, Pa.

1. Probably no one whose attention has not been specially drawn to the subject, has an adequate idea of the importance of our milk-supply from an economic and commercial point of view. In some papers of mine,—published in the Philadelphia *Medical Times*, June 21, 1879; the *Journal of the Franklin Institute*, Philadelphia, January, 1880; and the *Sanitarian*, New York, November 22, 1883,—are given the data from which I have estimated the milk-supply of Philadelphia at two fifths of a pint for each inhabitant daily; and Dr. Jacobi (*Artzl. Zeitsch. Breslau*, August 28, 1880) estimates that of Breslau at rather less than half a pint per diem for each inhabitant. But Dr. W. K. Newton, of Paterson, N. J., writes me that his estimate of the principal cities of New Jersey is at the rate of two thirds of a pint for each person daily, and the returns from other cities (which have been kindly furnished to me with other important information, for which, as well as for the interest and trouble they have taken, I here return special thanks and acknowledgments to Dr. Pooler of Goshen, N. Y., Drs. H. O. Marcy and S. W. Abbott of Boston, Mass., Drs. Kemper and Miles of Cincinnati, Dr. Jas. A. Steuart of Baltimore, and Mr. J. C. Cabanne and Dr. Coles of St. Louis) seem to show that this is nearer the truth.

The following table has therefore been formed, partly from the absolute returns available for the purpose, and partly from Dr. Newton's estimate. I have also inquired as to the wholesale and retail prices, and find that they average (winter and summer together) in the different cities 4½ cents per quart wholesale, and 7½ cents per quart retail. In Paris the price is 10 to 12 cents per litre; in Breslau, 30 pfennigs per litre.

City.	Population.	Milk-supply—quarts.	Wholesale cost.	Retail cost.
New York	1,280,000			
Brooklyn	560,000	180,000,000	$8,100,000	$13,500,000
Jersey City	130,000			

Philadelphia	990,000	75,000,000	3,375,000	5,625,000
Boston	370,000	34,000,000	1,530,000	2,550,000
Baltimore	340,000	30,000,000	1,350,000	2,250,000
St. Louis	360,000	32,000,000	1,440,000	2,400,000
Cincinnati	280,000	24,000,000	1,080,000	1,800,000
Newark, N. J.	147,500	18,000,000	810,000	1,350,000
Hoboken	73,750	9,000,000	405,000	675,000
Paterson	57,400	7,000,000	315,000	525,000
Camden	50,000	6,000,000	270,000	450,000
Trenton	33,000	4,000,000	180,000	300,000
Elizabeth	24,500	3,000,000	135,000	225,000
Plainfield and other cities in N. J.	50,000	6,000,000	270,000	450,000
	4,746,150	428,000,000	$19,260,000	$32,100,000

Dr. Patton's estimate of Cincinnati is evidently too high. I have reduced it to a yield of 2,000 quarts per cow. For the cities of New Jersey I have given Dr. Newton's figures, though I think them rather high. I have increased my estimate of Philadelphia, so as to include milk furnished and sold from wagons from adjacent farms in Delaware and Montgomery counties, and from Camden. St. Louis is estimated.

It will thus be seen that among us, in a total city population of nearly 5,000,000, there are annually consumed over 400,000,000 of quarts of milk, costing the consumers $32,000,000, of which, however, less than $20,000,000 are returned to the producers, the other $12,000,000 being absorbed by the middlemen and retailers.

Such are the aggregate results of the pennies paid out often by the poor sickly woman, or the ragged child, to the milkman as he stops his cart at the entrance of some alley. The importance, the absolute necessity to them, of this article of food, is also often overlooked. What would be the result were the milk-supply cut off? The failure of the wheat crops through the entire country would be less serious, for we could live on corn-meal, oats, rice, or potatoes; but what could replace milk?

2. Having thus seen approximately what we pay for milk, and what we expect of it for nourishment, especially for our little ones, let us next consider the article purchased and furnished. Is it good, whole, true milk, such as those of us who were born and bred in the country remember to have had in our youth? Or, is it a thin, watery, ghostlike semblance of its former self? Is it pure, or is it too often foul? Does it or does it not too often carry lurking in it the germs of disease, such as typhoid fever, scarlet fever, and diphtheria? The medical journals of late years contain but too many accounts of epidemics clearly traceable to

this source. But this is beside the main point we have now to consider, viz.,—

The probable extent of the *adulteration* of our milk-supply, *i. e.*, the diminution or alteration of its nutritive qualities.

The average price received by the farmer from the middleman, as stated above, is nominally 4½ cents, while the cost of production, with hay at $15 per ton, is 4 cents. This leaves the farmer a margin of only half a cent per quart profit for all his labor, trouble, and risk—a very small margin. But too often it is impossible for him to get it. Under one pretext or another, the middleman, when he settles with him at the end of the month, reduces the price to 4, 3, or even 2½ cents, tells him he can take that or nothing, and the farmer is obliged to submit; perhaps seeks another middleman in hopes of finding better treatment, only in a few months to be served in the same way. To protect himself, the farmer too often takes off the "top of the can," or the cream from the evening's milk, and thus partially skimmed milk is, by the habit of the trade to a great extent, sent to the middleman or retailer. This, again, is received too late from the train for early morning delivery to those who insist on having "fresh milk for breakfast." So the middleman puts it away till the next morning, and then serves them with fresh cream and *fresh milk*, whole (!) milk, thirty-six to forty-eight hours old, and with as much cream taken off meanwhile as his customers will kindly allow. What wonder, then, that we find town milk different from country milk! What wonder that Dr. Davenport, of Boston, this summer found that of 600 analyses made by him, 400 showed deficiency of cream, and a very considerable proportion showed an addition of water by the diminution of the solids! What wonder that in 1883, in New York, from analyses and investigations made there, Dr. H. A. Pooler, of Goshen, found that the daily milk supply of New York, Brooklyn, and Jersey City, amounting to 500,000 quarts, was made up of 300,000 quarts of genuine milk, 80,000 quarts of skimmed milk, and 120,000 quarts of water! From such figures as these, and from our own experience and knowledge, we may infer the great extent of the deterioration and adulteration of town milk, to say nothing of the product of swill-fed, badly kept cows. And yet such as it is, deprived in three cases out of four of more or less of its cream, and diluted more or less with water, we put up with it, blame indiscriminately the farmer, the middleman, and perhaps our own servants, pay our milk bills, and take the consequences. What some of these are, I shall presently try to show. The army employed in the trade, the difficulty of hunting down and punishing the frauds, and the trouble involved, seem so great that we are too often tempted to give up in despair. Sometimes stung by too glaring a fraud, complaint is made, and a man or two here and there is arrested and punished; but the villainy goes on almost unchecked, until a community like that of New York or Boston is aroused, takes earnest measures, and results are reached which may well demand our careful serious thought and attention.

3. It is evident that the worst effects of the adulteration of milk are to be sought among young children, of whose food it necessarily constitutes so important an element. When we remember that probably not one mother in six in our country is able to nourish her infant from her breast for one year, or even ten or eight months exclusively, and that for the first three or four years of life milk enters largely into the food of children, we are forcibly reminded also of the large proportion of mortality of children under five years of age in our large cities, due to diseases of the digestive tract, and want of primary assimilation. We think of the ravages among us of cholera infantum, of entero-colitis, of troubles of dentition, and marasmus. In Philadelphia, in 1883, the deaths were as follows:

Under one year of age	20.92	per cent.
Between one and two years	6.89	"
Between two and five	9.13	"
Total under five	36.94	"

of the *deaths from all causes* in the city during the year; and the deaths under five years have steadily increased with the population. I may mention that we have no milk, meat, or vegetable inspection in this city.

The following table is worthy of study. It has been compiled from the New York health board's official report (mainly) for 1882:

City.	Population.	Death rate per 1,000 inhabitants.	Births.	Deaths under five years of age.	Deaths from diarrhœa, etc., under five years.
New York	1,279,577	29.64	28,321	17,520	3,479
Brooklyn	565,689	24.84	10,656	7,136	1,600
Boston	362,839	23.42	10,986	3,172	789
Baltimore	332,790	21.84	7,759	3,755	582
Cincinnati	255,708	24.55	7,101	2,904	427
St. Louis	350,522	19.61	8,441	3,454	525
Philadelphia	886,539	22.62	20,098	7,254	1,814
London[1]	3,816,483	21.29	133,200	36,259	1,918
Paris	2,239,928	26.21	62,587	17,411	5,109
Berlin	1,174,293	25.94	44,446	17,266	Estimated 5,000
Vienna	726,105	29.16	29,262	8,903	1,389
	11,990,473	....	362,877	125,034	22,632

[1] The deaths in London from zymotic diseases in 1882 were very large; and probably many cases which would here have been certified to under the head of diarrhœal diseases, etc., were included un-

We thus see how large a part of this infant mortality is due to diarrhœal diseases. How much of this is to be attributed to bad milk?

Dr. H. A. Pooler, of Goshen, N. Y., writes,—

"The amount of milk fluid used in New York city, Jersey City, and Brooklyn, in 1882, was about 500,000 quarts per day, made up of 300,000 quarts of pure milk, 80,000 quarts of skimmed milk, and 120,000 quarts of water. The 200,000 quarts of adulteration by water and skimmed milk so reduced the nutriment as to produce an increase in the mortality of children to a fearful extent. The amount of adulteration was reduced from 200,000 to 100,000 quarts per day by the persistent efforts of the board of health, aided by the facility the railroads gave them by allowing them to inspect the milk *in transit* on the trains to the city, which has had a very happy effect by reducing the death rate of children in the city of New York alone, under five years of age, 3,673 *less in* 1883 *than in* 1882, other conditions of the city being about the same. We found the adulteration was done by the middlemen through whose hands the milk passed."

This is corroborated by a letter of Dr. John T. Nagle, who writes from the bureau of vital statistics, New York, September 3, 1884:

"The deaths under five years of age in 1880 were 14,650; in 1881, 17,737; in 1882, 17,520; in 1883, 13,856. The continual inspection of milk, and the arrest of persons dealing in milk which is adulterated or skimmed, has had a perceptible effect. * * * The continual vigilance of the sanitary officers has made it dangerous to sell milk below the standard of specific gravity. The effect on the infant mortality cannot be given, but it is safe to say that it has had a very beneficial effect. The proportion of deaths of children under five to the total mortality has declined. In 1873 it was 48.76 per cent., and in 1883 40.74 per cent."

Dr. H. O. Marcy, of Boston, writes, September 23, 1884,—

"Dr. B. F. Davenport has been our milk inspector only for three months last past. He has taken the work up very carefully, and has now made nearly 1,000 analyses. About two thirds of the first 600 showed more or less loss of cream, and a very considerable portion showed diminution in solids. The law has been vigorously enforced, and wholesome fear already exists. The supply of milk has correspondingly improved in quality. * * * The result of our committee's investigation (during last spring) was, that the milk producers were usually honest and badly paid, receiving very small compensation for hard toil, that the contractors and shippers usually deliver milk as received, but that the 'middlemen,' generally small dealers, were the adulterators. * * * The deaths in Boston from cholera infantum during June, July, and August, 1883, were 447; those during the same months in 1884 were 348,—showing an apparent lessening of 99 deaths this year. It must, however, be borne in mind that our season has been exceptionally cool."

Dr. Andrew C. Kemper, of Cincinnati, writes,—

"This, from the first annual report of our board of health, may interest you: 'Nearly one third of the children born in this city during the year ending February 28, 1868, died before the completion of the first year of life.' That was before milk inspection."

der convulsions, teething, etc. Still, even then, the death rate from diarrhœa is low. The Registrar-General's report for all England, for 1882, gives as causes of infant mortality,—

Diarrhœal diseases	7	per cent.
Debility, atrophy, inanition	10	"
Convulsions	11	"
Inflam. of brain	3	"
Dentition	3	"

Those reported above constitute about 5½ per cent. from diarrhœal diseases.

Again:

"Inspection has decidedly bettered the quality of milk, and decreased infant mortality, as per my observation in general practice, and five years in the Cincinnati Orphan Asylum."

From the above, I think we may fairly conclude that of the deaths under five years of age in our large cities at least *one fifth* are directly traceable to the inferior milk supply, if indeed this is not too low an estimate, so that of the 125,000 deaths given in the above table for 1882, 25,000 would have been saved by an improved milk supply, or over 1,400 each year in this city of Philadelphia alone, and 700 in St. Louis. Surely such facts as these are enough to rouse us from our apathy.

4. What can be done to improve our supply, to obtain the genuine article at such a rate as to place it within the reach of all classes of society? We have heard the testimony as to the efficiency of inspection, when scientific, complete, and thorough; but this must be constantly maintained, and is expensive. The local and state governments have been, with varying measures of energy and success, at work in this direction. No duty can be theirs more plainly than the protection, against such frauds as I have indicated, of those who are too poor or ignorant to protect themselves. But little can really be accomplished until the public is made to realize the incorrectness of their notion that "all milk is milk," whether good or bad, rich or poor, adulterated or honest, pure or foul. When the public does realize that there is a difference, and shows its appreciation by paying an honestly remunerating price for a good article, and for that only, the good article will be had, and will drive the bad out of the market. Inspection is necessary, and rigid laws vigorously enforced. Where the state has neglected or imperfectly performed its duty in this respect, private individuals or companies have taken it up, as the Aylesbury Dairy Company in London, or the St. Louis Dairy Company in St. Louis. But the expense attending such ventures of private capital is such as to seriously handicap them in the commercial conflict with rascality. There is another method which has been succesfully tried in Paris by M. D'Arcy, in New York by Mr. F. R. Starr, and by myself and others in Philadelphia. I allude to the shipment by the farmer of milk in quart glass jars or bottles. This method gives rather more trouble to the farmer, but my experience has been, and is, that the citizen will gladly repay him by the advanced price given for a good article, if necessary. I have, however, not asked more than others, and find it pays me better than my neighbors are paid by the ordinary milk contractors. It consists simply in cooling the milk thoroughly and quickly, straining it into the jars, and closing them and sealing with a label, bearing the name and address of the producer, and the date of shipment. The advantages of the method are,—

1. The milk must be clean, as any dirt would show in the bottom of the jar. This is a great advantage over any method of shipment in tin cans, and is very important in a sanitary point of view, as has been well

shown by Dr. Miles, of Cincinnati. The filth which accumulates in the bottom of the forty-quart cans is enough to sicken any one.

2. It is free from contamination with foul air or disease germs *in transit*. This is another great sanitary advantage, as alluded to above.

3. Each customer gets an exact measured quart, with its own proportion of cream, as it has been put up before the cream could rise. If desired, the cream can readily be decanted separately.

4. It is the producer's interest to send the best article he can, as his name accompanies each quart, and therefore his reputation and the price he receives depend on the quality of the article he sends. Such, in brief, is the system of milk shipment I have practised successfully, and with a constantly increasing demand for the last eight years. It has been a pecuniary success with me, as with Mr. D'Arcy and Mr. Starr, and several others are following it in Philadelphia, which is the best proof I can adduce of its success. I trust it may commend itself to you, and through you to the community at large in our country. Let us try to do something, at least, to lessen the terrible infant mortality I have shown.

XXXI.

ON HEATING AND VENTILATION OF DWELLINGS AND SCHOOL-ROOMS.

By CHARLES O. CURTMAN, M.D.,

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When we are charged with the construction of heating apparatus for industrial purposes, we must, besides security from dangers by fire, observe three principal points. First. the obtaining of the greatest *quantity* of heat from a given amount of fuel; next, the production of heat of such *quality*, that is, of such intensity as well as quantity, as is most appropriate to the purpose; lastly, the heat must be applied in such manner as to be easy of access for the workman, and conducted to the place of use in the most economical manner.

When, however, our purpose is to heat dwellings, schools, and other localities in which men live and congregate, we are met by another demand of still greater importance than the preceding points, a demand which we dare not neglect without incurring the most serious risks, the care for life and health of the occupants. It is to be regretted that this care is not sufficiently appreciated, that even where we might expect better things, a lamentable lack of information, or careless neglect of the subject, prevails.

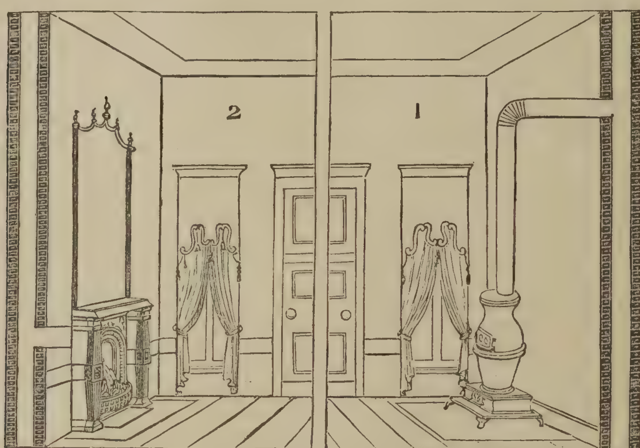
However much the modern methods of heating appear to differ from each other, they may be conveniently arranged into three classes, which, while resting on the same foundation, have each their peculiarities, advantages, and disadvantages. The common source, from which they all draw, is the force of chemical affinity of the atmospheric oxygen for the constituents of fuel, metamorphosed into the force of heat. It matters not whether we select anthracite, the comparatively pure carbon, or coke, or the bituminous coal, rich in hydrocarbons, or wood, or coal gas, heat is made available in exact proportion to the process of combustion; *i. e.*, the union of oxygen with carbon to carbonic acid gas, and with hydrogen to water. If air be not supplied in sufficient quantity, this process of combustion remains imperfect, and, instead of the above ultimate products of combustion, there is formed carbon monoxide, unburnt carbon, and hydrocarbons poor in hydrogen. Hence considerable quantities of soot and dense masses of stifling smoke escape from the chimney, and indicate the loss of valuable material, and deteriorate the air. Even when the supply of air is fully sufficient, a faulty construction of the hearth may prevent its intimate contact with the burning coals, and give

rise to the same disadvantages. In similar manner, an excessive flow of air may cool the flame, and thereby prevent the formation of the perfect end-products of oxidation, and thus entail a loss of heat.

Whatever system of heating we may therefore choose, the one *indispensable* condition for success is an adequate, well regulated supply of air to the fuel. The manner in which this air is procured is one of the most important factors in the heating and ventilation of rooms, and upon it depends the great difference in the successful solution of this problem.

In the *first class* of heating apparatuses we find those *which take their necessary supply of oxygen from the room itself*, *which they are designed to heat*, in which, for this reason, *they effect an automatic ventilation*.

An almost endless variety of stoves, and the open grate fire-place, still so popular throughout the country, belong to this category. Let us take



the simple cast iron cylinder stove as an example (see Fig. 1). Wood or coal is burning on the grate below the fire door, and through the ash-pit, below the grate, air enters from the room to supply the fuel. For every volume of oxygen which combines with the carbon to form an equal volume of carbonic acid gas, five volumes of air containing about four volumes of nitrogen, flow to the hearth of combustion. The product of this combustion, though specifically heavier than air, is so expanded by heat that it becomes much lighter than the surrounding cooler air out of doors. Hence, it rises in the chimney-flue, and escapes at its top, while from the room, other air rushes into the stove to replace the loss.

The heat of the glowing coal and of the flaming gases is communicated to the metal of the stove, and from this, partly by radiation, partly by contact, to the air, the walls, and the furniture of the room. The degree of completeness of this communication depends, to a great extent, on the form and material of the stove. Extending the surface by ornaments, increasing the power of radiation by covering with graphite, are

resorted to for obtaining the best results. Mica plates take the place of opaque metal to permit the luminous heat rays to enter the room directly, instead of being converted into the less intense dark heat rays by the opaque metal. By absorption of the rays, the temperature of the walls rises, the air in the room is expanded to a larger volume, and this accession to its bulk is rapidly carried off through the stove by the upward current of the chimney. If other apertures are not purposely provided, the cold air from the outside pours in through every crevice of doors and windows to replace that used in maintaining the combustion of the fuel, and in this way a sufficient amount of ventilation is secured to prevent accumulation of the gases of expiration in quantity sufficient to endanger the health of the occupants.

With this great advantage, however, some unpleasant features of this method of heating must be taken into the bargain. Among them, the dust and dirt inseparable from the removal of ashes and bringing in of fuel is not the only disagreeable one. More serious would be the introduction of carbon monoxide and other gases of combustion through the red-hot metal of an over-heated stove, but the experiments of Prof. Remsen have shown that the fears excited by the publications of Deville and Troost are exaggerated. The influx of a current of cold air from without is especially obnoxious to those occupying the places near the windows, otherwise so desirable on account of the light. Imperfect sewer traps would also be more likely to discharge their noxious gases into a room whose reduced atmospheric pressure makes it act as an aspirator, but this may be obviated by rapidly compensating the difference in pressure by suitable arrangements for admitting air from without.

The open grate or fire-place in the chimney (see Fig. 2) belongs to the same class of heaters, and in principle closely resembles the stove. The air requisite for combustion of the fuel is taken from the room, and hence a most powerful ventilation is insured. But on account of its lesser surface for communication of heat by contact or radiation, a less advantageous result is obtained than by combustion of the same amount of fuel in a stove. Through the large opening above the fire, the warm air from the middle strata of the room rushes into the chimney in great quantity without having contributed to the process of combustion, thus giving us continually the same condition as that of a stove with the fire door opened to moderate the draft through the fuel on the grate. This increases, to a certain extent, the influx of cold air, and produces an excessive amount of ventilation at the expense of the temperature of the room, so that the luxury of an open fire-place can only be indulged in where fuel is cheap.

The *second class of heating apparatuses* consists of those *which do not take air required for combustion of fuel from the room to be heated*, *and which produce their effect principally by the heat emitted from a stove or radiator placed within the room*, *but fed with fuel from without*.

This system of heating is held in great esteem on account of its cleanli-

ness and convenience, and in buildings designed to combine elegance with comfort, is considered the only correct thing, in spite of its expense.

Best known among the older appliances of this class is the porcelain stove with fire door external to the room, still found in some old mansions in the former Dutch colonies. On its model, more recently, stoves of metal, steatite, or porcelain tiles have been constructed, but are not very extensively used. The huge structure of clay, serving at once as stove and as sleeping-berth, found in many parts of Russia and other cold countries, belongs to the same category. Modern technic has replaced these heaters by steam or hot-water heating apparatuses, which, though varying greatly in appearance and detail of construction, depend upon the same principle.

The porcelain stove with outside fire-place (see Fig. 3) may serve to illustrate the leading features in their simplest form. The stove is placed near the wall, and its fire-door and ash-pit do not open into the room, but, by means of a lengthened neck, penetrate the wall, and permit the introduction of fuel and the removal of ashes from the outside. This gives the advantage of excluding from the room every vestige of coal-dust or ashes, and such accidental puffs of smoke as may be driven down the chimney during stormy weather. Every stove requires a special external fire-place, and every room a stove.

The modern steam or hot water heaters have the important advantage over this stove, that every room of a large building may be heated from a single central furnace. A single fire-place under the boiler suffices for all the radiators of the house. Hence fuel and ashes are handled only in the basement. The danger from fire, otherwise threatening from every room, is reduced to a single locality, and therefore to a minimum. Added to this is the great saving of labor as compared with that involved by taking care of many separate fire-places. The steam, generated in a

stout boiler, circulates in strong metallic tubes, expanding in each room into a network (see fig. 4) called the radiator or coil, which by contact and radiation raises the temperature in the same manner as the simple stove of the first class. As the heat is gradually lost by successive transfers to the air of the rooms, the steam in the pipes condenses again into water, and is returned by the system of pipes to the boiler, from which it starts again on its circuit.

Where hot water is used instead of steam, the boiler is generally contracted in size while the calibre of the pipes is enlarged, and in these water below the boiling point circulates in the same manner as steam in those just described. In both of these kinds of apparatus the influx and return of steam or water may be regulated by means of appropriate valves, so that each room may be included into the circuit or excluded from it entirely or partially. Thus in cleanliness and nicety of adjustment of temperature this system leaves nothing to be desired.

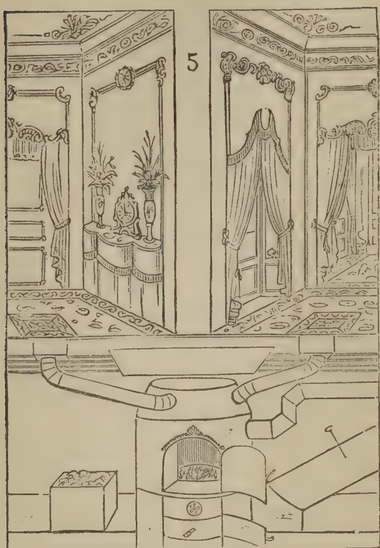
Let us next consider the sanitary influence of heating by an apparatus of the second class. The air of a room thus heated is at first expanded, and the increase in volume produces a pressure which is relieved by an outward flow of the excess in bulk. This, however, is not very powerful, nor does it last long, and as soon as the temperature becomes stationary the exchange of air in and outside of the room to a great extent ceases. If the walls are of brick or other porous material, and not obstructed on their inner surface, the *diffusion* of air goes on actively yet, but where they are covered with oil-paint or other impermeable material, this *diffusion* cannot take place, but occurs quite independent of the method of heating, and is only mentioned incidentally. When the room cools again, its air contracts and calls forth, during such contraction, a corresponding moderate influx of cold air from without.

It is evident that in a room heated in this manner, with so little change of air produced by automatic ventilation, the respiration of the occupants will soon reduce the amount of oxygen, and replace it by the gases of expiration. Hence the addition of a *separate ventilator*, *as an indispensable supplement* to an apparatus of the second class, is a matter of greatest importance, for all of them are nearly *devoid of that automatic ventilation* which forms so essential a feature of the first system. *Without such additional ventilation*, *even the most elaborate and elegant steam-heater is to be denounced as a nuisance*, dangerous to health and life, and should be most especially rejected as a means of heating school and assembly rooms, where many persons are congregated for hours, and thus rapidly diminish the oxygen of the included air.

The *third class* of heating appliances introduces the heat into the room in the shape of *a current of hot air*. Here, as in the method of heating by steam or water, all of the separate rooms of a house are supplied from a central furnace. Whatever the variety of their construction, they substantially agree in the following features (see fig. 5).

A large furnace of strong metal is located in the basement, surrounded at a suitable distance by a mantle of either masonry or sheet metal. This

mantle entirely encloses the furnace, whose fire-place and ash-pit are reached from without by metallic tubes, penetrating the mantle but having no communication with it. To the base of the chamber, thus formed around the furnace, a large conduit admits the cold air from without, while from its top a number of smaller pipes and flues conduct the heated air to its destination. Registers and valves permit the regulation of the air current at every desirable point.



We have thus two systems of pipes and flues having no direct communication with each other. The one consists of the air-chamber and its connections; the other, of the furnace with its smoke-pipe leading into the chimney, its feed-box and ash-pit accessible from the basement. When fire is kindled in the furnace, the fuel is supplied with air from the basement through the ash-pit. The gases of combustion escape into the chimney through the smoke-pipe, which penetrates the mantle without communicating with the air-chamber. The air of the chamber surrounding the furnace becomes hot, expanded, and hence so much lighter that it ascends through the air flues into the rooms. The greater the difference of the temperature in the air-chamber and that of the room, the more active the ascending current. It is replaced by cold air from without, entering through the cold air conduit at the base of the chamber, to become in turn heated and rise. In the rooms this ascending current of warm air creates an increase of pressure, and hence an efflux of the excess of air from the room. When no special aperture is provided, as it should be, near the floor of the room, every crevice of doors and windows permits the escape of the superabundant air to restore the equilibrium of pressure. We have thus a very active change of air, a ventilation which is the reversed counterpart of that produced by heaters of the first class. Instead of cold air entering to replace that escaping through the chimney, we have warm air entering the room by the air flue, and the cooled excess escaping to relieve the pressure. Hence the place near the window, so desirable on account of its light, may be chosen without fear of being annoyed by the cold drafts entering from without. The increased pressure within the room also acts as a check on the discharge of sewer gas by imperfect traps, and thus offers a greater security against this danger than any other method of heating.

But this system of hot-air heating has some drawbacks as well as

advantages; they may, however, be avoided or counteracted with but little trouble. One of the disadvantages it is charged with arises from the introduction of dusty air from without. This it shares with every method which uses active ventilation, but has some peculiarities. The street dust of every large city abounds in organic particles, and when these come in contact with the heated furnace in the air-chamber, they are charred and mingle their decomposition products with the ascending air current. On very dusty days this leads to the supposition that the joints of the furnace or of its smoke-pipe had opened and permitted smoke to escape into the air-chamber. This however but rarely occurs. The remedy consists in so placing the external opening of the cold air conduit that it may receive its supply of air furthest from the dusty street, and as high as possible above the ground. There may also be placed on the floor of the air-chamber a large shallow trough filled with water, which can be frequently changed, over which the air is compelled to pass and deposit most of its dust. Sieves and strainers have not proved very serviceable. The size of the furnace somewhat influences the result. A small furnace must be kept at a very high heat to raise the temperature of a large air current, and hence will more readily scorch and burn the organic particles of the dust, while a larger furnace will accomplish the same rise at a much lower heat. Hence there is less charring, and the air entering the rooms is just as pure, or impure, as that introduced by any other mode of heating with equal amount of ventilation from the surroundings of the house.

In regard to *dryness* of air, the hot air method is reputed to yield the dryest air: next to it is esteemed the common stove and the grate fireplace: lastly, the steam or water heating, which is claimed as furnishing air of the last degree of dryness. But though *dry air* is here spoken of, this is not really meant, but in reality *drying air*, for neither of the three methods of heating here discussed changes in the least the amount of moisture in the air. This is not affected by increase in temperature, for, however much heated, the air retains its percentage of aqueous vapor which it brings from without into the room. But with every increase in temperature the capacity of air for dissolving aqueous vapor and withdrawing moisture from other bodies is increased. Now if the air remains at rest within the room, with little or no change by ventilation, it will soon be saturated again, even when its temperature rises considerably. Hence the occupants of the room or its furniture will suffer but little loss of moisture in rooms heated in any manner, but imperfectly ventilated. The moisture of expiration more than suffices to fully saturate the heated air. Therefore we never hear complaints of too great a dryness of the air in rooms heated by steam or water, and unprovided with active ventilation. With a rapid change of air this is different. The air whose capacity for moisture is increased by heating, saturates itself during its passage through the room, and thus carries out moisture in proportion to its temperature, and greater or less rate of velocity of passage. The better the ventilation the greater the complaints of "*dry air*." But this is entirely

independent of the method of heating. Every cubic foot of air entering from without at a temperature of 0° C., and leaving the room at 16° C., will carry out with it an equal amount of moisture, no matter by what kind of apparatus its temperature has been raised. Moreover, this drying quality cannot always be counted as a reproach. Many persons feel more at ease in such an atmosphere than in any other, and if they complain, it is not of personal discomfort, but of the drying out and shrinking of the furniture. Besides, it is so easy to increase the moisture of the air by placing suitable vessels, filled with water, in the air-chamber or upon the stove, only they must not be forgotten, and the neglect to fill them charged upon the heater. We pass over other devices for heating, less frequently used, because they may be readily assigned to one or the other of the three systems described, or else combine some features of more than one of them.

With the exception of the open chimney grate, nearly every apparatus for heating has more or less perfect appliances for regulating the combustion, and by these means the temperature of the room. Dampers for controlling the escape of the smoke, such as those in ordinary use in stove pipes, may easily, by carelessness or accident, become dangerous, and should therefore never permit perfect closing of the vent. By such arrangements the total quantity of heat supplied to a room may be readily kept within certain limits. But this does not by any means satisfy all just demands, and the *equable distribution of heat* within the room is a matter of great importance, which has not as yet received the deserved attention. So long as the object is to heat the rooms of a private dwelling, occupied by but few persons, who can change their place without difficulty, the unequal distribution of heat may be tolerated ; but in a crowded school-room a proper regard to discipline would render such moving about of the pupils, to hunt comfortable places, a matter of great difficulty, or preclude it entirely. Imagine the situation of children in a spacious hall improperly heated : those near the single huge stove are suffering from excessive heat, while those in the distant seats are chilled. The teacher, if his desk be located in the cooler part of the room, is inclined to urge the fire, to the great discomfort of those near the stove ; but if he is in close proximity to the source of heat, windows or doors are opened at once. What happens ? The cold air flows into the lower strata next to the floor, while the upper strata still remain at their high temperature. Cold feet and heated heads are not generally supposed to be conducive to good health, and many a weakly child carries the germs of fatal disease out of such a school-room. Very simple devices would in such case suffice to effect a better mixture of the unequally heated strata. A piece of board a few inches in width, fitted accurately under the lower sash of a window, will raise it without permitting air to pass under it, while it opens between the sashes a narrow slit, open above, through which the cold air rushes in with sufficient force to reach the ceiling, and from thence gradually intermingles with the heated strata. Ventilators placed against the walls should have their openings directed upward, so as to effect a thorough mixture of the super-imposed strata, and prevent by continual motion a stratification of the differently heated

layers according to specific gravity. Subdividing the sources of heat, placing two smaller stoves in opposite parts of the room instead of a single large one, and distributing hot-air inlets and radiators judiciously, will effect a more equable lateral distribution of the heat.

Next to the introduction of sufficient heat, and its proper distribution, in whatever manner effected, its proper *conservation* deserves attention; for the heat of a room is continually suffering loss from various causes, and unless we reduce this loss to a minimum, even the best method of heating does not protect us from needless waste of fuel. Careful experiments have shown that by cooling of the outer walls, by opening of doors, and by the necessary ventilation, an average loss of heat is sustained, so great as to require five or six times the amount of fuel which would keep a room protected from such losses at the comfortable temperature of 20° C. to 21° C. (68.4° F. to 70° F.). Hence, care must be taken to have walls built of sufficient thickness, so that in brickwork the joints may be so broken, that not a single brick (or stone) may reach from the inner to the outer surface of the wall; and, better still, so that the wall may consist of two layers separated by enclosed air. Heating the halls and stairways upon which the doors of the rooms open, providing double sashes to windows and double shutters to doors leading to the open air, and avoiding metallic conductors in the walls, are all means of preventing loss of heat, well known, but often neglected.

In conclusion, a few remarks on the masses of air set in motion by the process of combustion. Using an ordinary stove, and selecting as fuel anthracite, which contains about 98 per cent. of pure carbon, we find that for every pound of fuel burned, two and two thirds pounds of oxygen, measuring about thirty-two cubic feet, are consumed. This corresponds to nearly 160 cubic feet of air. As much air escapes through the chimney unburnt, we need not wonder that Regnault's experiments led him to nearly double that amount, and assume that 312 cubic feet of air are required for every pound of anthracite burnt in a stove.

A school-room twenty by thirty feet in extent, and twelve feet high, contains 7,200 cubic feet of air, weighing about 540 pounds. If during a cold winter day 300 pounds of coal are burnt in the stoves of this room, there will be (according to Regnault) 93,600 cubic feet of air, weighing over 7,000 pounds, passing through the stove into the chimney. In other words, by the mere automatic ventilation produced by the burning of the fuel, the room, containing 7,200 cubic feet of air, must be emptied and refilled thirteen times in a day; but as the period of active firing does not usually occupy more than nine hours (from 7 A. M. to 4 P. M.), the air is emptied and replaced about once in every forty minutes during school hours. Within these forty minutes, fifty children would inspire about 600 cubic feet of air, from which they would remove about six cubic feet of oxygen. The rate of ventilation in such a room, produced automatically by an ordinary stove consuming 300 pounds of coal, is therefore more than sufficient for even a greater number of occupants, and in warmer days, when only one fourth of the fuel is consumed, ventilation will still be active enough for all purposes.

XXXII.

ON PROTECTIVE SPECTACLES FOR WORKING-MEN.

By ADOLF ALT, M. D.,

St. Louis.

Public hygiene has of late, and by right, paid a great deal of attention to the eyes, the organ without which we can hardly earn our bread or enjoy life.

I do not want to recapitulate to this honored assembly what has been done to find the causes of the increasing short-sightedness and their remedies, nor how the systematic examination of the color-sense of certain officials, and the detection of color-blindness, have undoubtedly prevented fearful accidents in those countries at least where they are rigorously enforced. I now want to draw your attention to another field, in which all of us, who are interested in the welfare of the public, can as yet do immense good: I mean the prevention of those injuries to the eyes to which nearly all mechanics are exposed.

All individuals working at a trade in which chips of iron, brass, wood, glass, or stone are likely to fly forcibly away from the material used in the manufacture, are, of course, likely to receive such chips in their eyes. If the force with which the chip strikes the eye is nearly spent, or not powerful enough, the foreign body will either strike the outer coat of the eyeball and drop off, or it will remain embedded within this coat. Such injuries are, as a rule, but slight, yet may become very important. If the force with which the foreign body strikes the eyeball is sufficiently strong, it will pierce the outer coats of the eyeball and enter it. Such an injury is always a grave one, and may entail the entire loss of the injured eye, and, if neglected, destroy the fellow-eye by what is called sympathetic inflammation.

In order to explain these matters better, I have brought here a drawing of a section through the human eyeball, by which you can see all the different tunics of the eye.

Foreign bodies which become imbedded in the cornea are, as a rule, easily removed, at least by one trained to remove them. The injury inflicted by them is originally but a slight one, and should not be increased by their removal. Yet the very fact that it is in most cases so easy to remove such foreign bodies from the cornea, has given rise to the custom, that before going to the proper place for relief from his suffering the injured mechanic will almost invariably submit to the clumsy and dangerous attempts at removal of the foreign body by one of his fellow-workmen. The instruments used by these greatly honored and admired

"skilled" help-mates are of the most dangerous and varying kind, and frequently the poor injured workman has to undergo immense suffering, even sometimes the loss of an organ as valuable as the eye is, when the slightness of the original injury does not warrant in the least such a disastrous result.

When the foreign body has penetrated the outer tunics of the eyeball, the original injury is very dangerous in itself, although, of course, to a varying degree. The foreign body may remain in the space between the cornea and iris, or remain embedded in the tissue of the iris. In this case, if seen at once by the surgeon, the foreign body may yet be removed, perhaps, without any lasting defect of function; yet in most cases it is necessary to make an iridectomy,—that is, to remove a piece of the iris,—in order to get the foreign body out of the eye. Such an operation, of course, by increasing the size of the pupil, and taking away the possibility of prompt and sufficient contraction of this naturally so movable diaphragm, maims the eye for life.

But often the foreign body has penetrated even into the crystalline lens. Almost every injury to the crystalline lens produces the formation of cataract,—that is, causes the crystalline lens to become dim. Yet such a cataract develops but slowly, and, on account of the continued state of irritation in which the eye may be kept by this process, the injured workman may be unable to earn his and his family's living for a period extending over many weeks, if not months, and when the process of the formation of the cataract is finally ended, he is blind in the injured eye, and has then to submit to the operation of extracting the cataract from the eye, which may or may not be successful. In the former case, although sight is regained, it is of but little value to him without cataract-glasses, and in the latter case he is worse off yet, as he not only remains blind in the injured eye, but will probably be kept from work again for a longer period, or have to submit to the removal of this now totally blind eye, in order to be rid of his constant suffering and the constant danger to his so far healthy eye.

The same is the case whenever the foreign body has entered the vitreous chamber, and has either become embedded in one of the coats of the eye-ball, or is remaining within the vitreous body, or if it has passed through the eye-ball and become lodged in the orbital tissues behind the eye. In most cases these injuries I just mentioned (often, even, when we have succeeded in removing the injuring foreign body from within the eye-ball) cause a chronic inflammation of a painful character in the injured eye, which is the more annoying as at times by slight causes it becomes exaggerated. The unfortunate possessor of such an eye, which contains a foreign body, is therefore almost continually, or at least from time to time, unable to work, not to speak of the continued suffering and the danger to his healthy eye.

In the foregoing considerations I assumed always that the injured man has one good and healthy eye left. But what infinitely graver aspect has the question when the injured man has only one useful eye, and that one

the injured one! Yet this calamity is luckily not very frequent. Let us therefore simply consider what danger an individual incurs who, having two good, useful eyes, loses one directly by the injury, or by the after-effects of an injury.

It has for a long time been known that injured eyes, and most especially injured eyes in which the injuring foreign body remains lodged, and which in consequence, as a rule, suffer from a chronic inflammatory process kept up within their coats, are apt sooner or later (mostly in from three to six weeks after the injury has been received, but sometimes many years after) to destroy suddenly, or sometimes slowly, the sight of the uninjured fellow-eye. This affection of the uninjured eye has received the unscientific name of sympathetic ophthalmia, and various forms of this dreadful disease have become known to oculists. An eye once attacked by sympathetic ophthalmia is even at the present time almost certainly doomed to utter ruin, and but very seldom we have a chance to give the patient at least some sight by means of an operation, and then only many years after an eye has gone through this dreadful disease.

But you may ask, If there is no cure for sympathetic ophthalmia, can it not be prevented? Yes, it can, by the speedy removal of the injured eye. And here comes the dreadful experience which every oculist has to go or has gone through many a time, namely, that all his entreaties and warnings are cast to the wind and counted as nothing, not only by the unfortunate victim himself, but by his wife, whose life and whose children's life and education depend on the eyes of the now injured husband, who does what is in her power to keep him from submitting to the unavoidable necessity of parting with one eye, which is of no further use to him, in order to save one, at least, to earn bread with. Where is the oculist who has not seen such a poor workman return too late, and beg and beg of him to give back what he can never receive? Surely in these cases ignorance is *not* bliss. What infinite misery may not be due to the injury received by the man's eye, whose life, whose all, depends on the usefulness of that organ! But if, and in fact now-a-days this is often the case, the injured man at once follows our advice, and allows us to remove the offended and offending organ, he has, at best, lost one eye. A man can surely better afford to lose one eye than two; yet does he need to lose that one eye?

I now come to the point aimed at in this paper. Even the prevention of the occurrence of sympathetic ophthalmia, by removing the injured eye at once (thus cutting short also all suffering from the injury), as much good as it certainly has accomplished, is doing the thing only half way. Why not prevent the occurrence of the injury? This, however, is easier said than done; not because there are no means at our hand to prevent the occurrence of such injuries to the eyes of our working-men in a great many, even in most, cases, but because the men will not use them. Ignorance, carelessness, even vanity, are sufficient to prevent the working-men from using what in most cases would shield them, namely, protecting spectacles. (The best ones are made of mica.)

I think it is deeply to be deplored that employers are not held liable for such injuries received by their employés; not because I think it just to make the employers pay, but because this would lead (as it does in all countries where the law holds the employers liable) to their forcing such workmen as are exposed in their trade to injuries to the eyes to wear protecting spectacles while at work. In such countries the number of injuries to working-men's eyes has been so greatly diminished that sympathetic ophthalmia from this, its most frequent cause, has become a comparatively rare disease.

XXXIII.

THE CHEMICAL DISPOSITION OF SEWAGE.

By W. JOHN HARRIS, M. D.,

St. Louis, Mo.

To a very great extent the health of a city is dependent on the purity of its water-supply. Where a river is made the great receptacle for all the filth and refuse of the country through which it runs, and the water from this same river is used by the inhabitants all along its banks, there can, I think, be scarcely a doubt but that the death-rate will be much higher than it would have been had the whole population been furnished with pure water.

Have you ever thought of the amount of refuse that goes into a river? On all the hillsides, where cattle have been fed the whole winter, on the farms where vegetables have decayed and been trodden down by the stock, all this is washed down with the rains, and very much finds its way into the rivers. Along the Mississippi from St. Paul to New Orleans a great deal of the refuse from factories goes into the river. In the small towns most of the refuse from slaughter-houses goes into the river; and in addition to all this goes the sewage of thousands upon thousands of the inhabitants of the Mississippi valley. What is true of the Father of Waters is true of nearly all the rivers of the world.

The history of all time tells us that when the rivers of a country become full of disease producing material, the persons drinking such water are sure to suffer with sickness of one form or another. As an illustration: The river Thames, at the city of London, had become so offensive in 1864 and 1865 that it became necessary to cast into the river thousands of barrels of quick-lime during the summer of 1865. The records show that typhus fever was very prevalent during that year, and in addition to this it was the year of the cholera epidemic. Who shall say how much the foul condition of the river had to do with the production of the cholera?

It is more than probable that the condition of the docks at Marseilles was responsible for a great amount of the cholera there this year. The U. S. consul wrote in July last from that port,—"The old port is simply the estuary of a small creek, dredged out into a large dock, with a narrow outlet to the sea. The new ports are spacious harbors inclosed by miles of piers and breakwater, and deepened to navigable depth by dredging and excavations. Into these enclosed ports, which extend along two thirds of the shore front of the city, the entire volume of sewage is poured, and as there is only the surplus of the fresh water from the

city hydrants to dilute this turbid flow, and as there is no tide to maintain the circulation of sea-water through the enclosed ports, the inevitable result is that the latter grows foul and pestilent. The same conditions, unmitigated by equally vigorous sanitary measures, prevail at Toulon, and it is thought it was the dredging of a disused dock there during the months of April and May which developed the seeds of the present epidemic."

There can be no doubt that the condition of the water-supply in any community is responsible for the health of the inhabitants, or that epidemics of typhus, typhoid, and malarial fevers are often produced by foul drinking-water. In the neighborhood of large cities the population is entirely out of proportion to the area occupied, so that some means has to be adopted to carry the sewage away, and the best sanitary measure is that which thoroughly disinfects the sewage by some chemical measures previous to its passage into the rivers or streams of the country.

Where the sewage is conveyed directly on to the ground the soil soon becomes boggy. For a time it does well where the soil is very sandy; but as soon as the absorbent quality of the soil has been passed, then any further spreading over of sewage renders the locality very unhealthy, so that the disposition of sewage by irrigation is self-limited, the time being regulated by the original absorbent power of the earth. It is necessary to adopt some plan whereby the sewage of cities can be so acted upon by chemical agents that the surplus water can be conveyed into the rivers so purified that it will be impossible for them ever to become disease-bearing streams. Various plans have been adopted in Europe to secure this end, many that were entirely too expensive, and others that were impracticable. Of all the plans that have been put forward, probably that of Dr. F. Hillé is the best. Among others that have been tried may be mentioned the following: Lenk's alum process, by which eight pounds concentrated alum and twenty pounds common alum are added to a tank containing thirty-six thousand gallons of sewage. Another is the perchloride of iron process; another the phosphate of alumina process; another the A. B. & C. process, whereby alum, blood, and clay are added to the sewage, which is afterwards treated with sulphuric acid. This is a very expensive process, and not nearly so effective as Hillé's, which I have seen in operation in several of the large cities of England, and which is to-day successfully used at Tottenham and Windsor.

The materials used are,—

1 cubic yard of quicklime.
1½ cwt. of chloride of magnesia.
4 gallons common coal tar.

These amounts are used to disinfect one and a half million gallons of sewage. The lime is slacked first in a separate tub, and then the tar and chloride of magnesia are added. The sewage is pumped up as it comes from the sewer into a trough about three and a half feet wide and three feet deep. As it enters this trough the mixture of disinfectants is steadily

added. The trough is really a mixing-trough, and is constructed in the following manner: It is about four hundred and fifty feet long, and has a gradual fall: the sewage and disinfectants entering the upper end together meet with an obstructing board on the right side extending half way across the trough, then two feet further on is one on the left side, and so on alternately during the whole length, so that the mixture is constantly being thrown against the cross-boards during its descent to the settling tanks. These tanks are three hundred feet long by twenty-five feet wide, seven feet deep at one end and five feet at the other. The sewage runs in at the deeper end and passes over the shallow end, most of the solid material being retained in the deeper end of the tank. From this first tank it is conveyed to a second tank constructed in a similar manner to the first, from which the effluent water runs into the river in a comparatively healthy condition. The residue left in the tanks is pumped up, and after being allowed to dry is removed by the farmer for agricultural purposes.

The tanks are sometimes used for six or seven days, but four days is about the right length of time. At Tottenham there are three of the first tanks, two of which are generally kept in use while one is being cleaned out. Some such plan as this I think is the most practical and certainly the cheapest, and should be adopted by those cities more especially whose sewage discharges into slow or sluggish streams.

With a river like the Mississippi, where the current is strong and rapid, there is not so much danger from disease as there is where the water runs slowly or scarcely runs at all, but even here as the population increases some such plan as I have mentioned should be adopted. Its great advantages are self-apparent, and will prevent much sickness and death.

XXXIV.

PUBLIC HEALTH AND LEGISLATION.

By W. C. COOK, M. D.,
Nashville, Tenn.

The rapid means of transit at the present day, the inter-state and international commerce and travel which exist and will continue to increase, while they tend to establish the brotherhood of mankind and to advance the cause of civilization, must nevertheless bring along with their blessings many of the plagues of distant peoples to curse the communities to which they come with wretchedness, sickness, and death, unless some systematic and well recognized legal enactments are authoritatively interposed for mutual protection. How best to secure this protection from the ravages of epidemics, has already, and for some time to come must, engage the attention not only of this association, but medical men and health officers throughout the country.

An intimate acquaintance, experience, and practice during two epidemics,—one of cholera in 1873, the other of small-pox in 1882–'83–'84 (at Nashville, Tenn., during the latter, as the Davidson county health officer),—enables me to recount from a practical stand-point many of the difficulties that lie in the way of the health officer, as well as to look in the only direction whence adequate power to combat successfully all epidemics can be possibly derived, to wit, state or national legislation, one or both. But while the power and authority for medical officers to act must come from the congress or legislature, the wholesomeness and efficiency of any law must first and can best be determined by sanitarians, or the men daily engaged in the study and practical work of the health department of the country. Their experience and knowledge, by virtue of their calling and labor, must, will, and ought to be the guide for legislators, and the basis of all sanitary law. The old adage, that "necessity is the mother of invention," applies with as much truth and force in the formation of sanitary laws as in other departments of life. The stubbornness and destructiveness with which plagues have invaded different communities in this and other countries, and the inability of health officials to prevent, suggest the only possible remedy for our ills to be, power to act conferred by legislation. The extent of this power, the nature of the law, to whom entrusted for execution, which for the good of the people are questions which, by the rights of labor, experience, and expert knowledge, primarily belong to the medical and sanitary workers and counsellors of this country. It is but fair to pre-

sume, as we would have a right to expect, that any sanitary measure, well digested and approved by this great public health association, would meet with favor by any law-making power in the land. A concert of action among sanitarians is a *sine qua non* to the derivation of power. For communities to wait until an epidemic is upon them, and then be compelled to rely upon county courts, or suddenly improvised boards of health even, composed as are all courts with laymen, and many boards of non-medical men, is to subject the people to the dominion of ignorance without the aid of science and experience, in instituting measures having for their object the preservation of human life and the protection of property. Therefore, at the will of this association, and to medical health boards and health officers of this country, should ample sanitary laws be formulated to protect the people against all forms of epidemic disease, so far as possible, and to aid in their judicious management, which by proper committees should be brought before the legislatures of such states for enactment into law as would be deemed necessary.

An allusion to the experience to which the people of Nashville and Davidson county were subjected from 1882 to August 5, 1884, as to small-pox, may serve to illustrate the necessity of vigorous statutes bearing upon this class of diseases.

Although Tennessee can boast of a state board of health composed of gentlemen eminently fitted for their responsible trusts, and who have accomplished much for sanitary medicine, and the city of Nashville of an efficient board of health, and Davidson county of a court which have been generous in the expenditure with the city of about $125,000, still, notwithstanding all efforts to suppress it, it persistently remained in our midst for nearly two and a half years. Hospitals were opened, and well appointed, with food, bedding, fuel, nurses, medicines, and physicians: still, only about two thirds of the afflicted could be induced to enter their portals to partake of this charity of the county. Nine hundred and sixty-four persons, mostly colored, however, were admitted for treatment, many of them entering reluctantly, notwithstanding they left miserable huts in the alleys and lanes of the city, with scantiest supplies of the necessaries of life. In their ignorance and superstition, they feigned to believe that they were wanted there to be poisoned or killed by having water poured upon them, or made to drink it till they were dead; that they were forced to be vaccinated with small-pox virus. Thus the fears of many negroes were aroused, and extended to others. No amount of persuasion could induce them to go, and thus the disease spread in the community.

The negroes have but little fear of small-pox, believing it to be a God-given disease. The more superstitious of them regard it as an evidence of religious courage, mortification of the flesh, and acceptance with God, to bravely face it, as well as a direct visitation of Divine Providence. Hence they firmly believe and say, when the vaccinator proposes to protect them by the operation, "Go 'way from here wid your scratch pins. You can't keep off small-pox. God gibs us dat, and you can do no

good wid your baccinate. If I 's gwine to hab de small-pox, I 's gwine to hab it." Some affect to believe that the doctor vaccinates with small-pox matter, or some poisonous substance, which gives them disease, and kills. So a large per cent. of the lower class of negroes, and many of the same class of whites, have never submitted to the operation, and never will. It is frequently the case, when small-pox appears in a family, and all the other members are unvaccinated, that they refuse to heed the admonition of the doctor, and be protected. Hence the contagion spreads from one to another.

Another reason why the disease has been so difficult to manage is the refusal of the afflicted families to maintain isolation of cases. So, from ignorance and superstition mainly, a large portion of the sick people refused to enter the hospital, or to be vaccinated or isolated, and so its ravages were continued for more than two years. All these means, together with what virtue there was in guarding small-pox cases, though by persuasion only, were as effectually tried by local authorities as possible; and while we can but believe that much good was done, still the results were not satisfactory, chiefly because it was not believed by the authorities, and they were so advised at last by distinguished lawyers, that they had sufficient power granted them by the statute of Tennessee to forcibly send any one against his or her will to the small-pox hospital, or be vaccinated—the two most essential and effective methods of preventing and controlling the disease. It can hardly be doubted, had the health officers of Tennessee been clothed with adequate power to vaccinate, and send patients to hospital, but that a few weeks only would have marked the career of the disease when first introduced; but in the absence of such recognized power, ignorance, superstition, and fear have consigned to death, suffering, and sorrow hundreds and thousands of our people.

The question arises, Should not this association, state boards, and sanitarians throughout the country, arise to renewed individual and collective efforts for the public weal, and formulate and have enacted by the states a wholesome and efficient code of sanitary laws, properly empowering state boards, local boards, and health officers, so that all infectious, contagious, and epidemic diseases may be met and grappled with by the strong arm of civil law?

To show the efficacy of even supposed authority in suppressing small-pox, I will relate an occurrence coming under my observation at Nashville. Small-pox had prevailed in that community from March, 1882, to August 5, 1884, with varying severity. I often conferred with the state board of health on the subject, and asked for such authority as they possessed and could confer upon me. The nearest thing to a direct command in the law was, that the county health officer "should carry into effect such rules and regulations as they might prescribe, having for their object the stamping out and restricting of such epidemic diseases as exist in or threaten his county." The president of the board did not feel that this warranted him at first, and for nearly a year, to direct that

people should be quarantined, vaccinated, or sent to hospital. In the meantime the disease spread with increasing virulence. However, on March 11, 1884, I was directed by him to vaccinate, flag premises where the disease existed, and send those afflicted with the disease to the hospital. I embodied all this, and more, in a circular, including a clause of the law bearing more particularly on the yellow fever epidemic of 1878, which made the violation of any rule or regulation a misdemeanor, and finable from "$50 to $500, and imprisonment at the discretion of the court, one or both." The disease had steadily increased from October, 1883, especially in the thirteenth district of the county, to March, 1884, when sixty-four cases developed. On the twelfth of this month the circulars containing the above instructions and penalties were scattered broadcast throughout the community. The people read, believed, feared, and obeyed instructions, ceased to tear down flags, isolated themselves, remained in their own houses, kept their friends away, or went when sick to the hospital,—in fact, stopped communication, so that the number of cases was reduced from sixty-four in March to seven in June, 1884, on the 17th of which we had our last case; so that in about two and one half months, under the fear of violating the law and suffering fine and imprisonment, the disease, which had been in the county outside the city limits of Nashville for more than two years, disappeared from our midst. It is due the city health authorities to state, that by aid of the police department, and a general belief among the citizens that the city had the power to enforce obedience, they were enabled to rid themselves several times of the disease, only to wait but a short time to see it reintroduced from adjacent districts, when the weight of the law was not for a time so sensibly felt. This corroborates the position, that to properly manage small-pox, or any kind of epidemic disease, sufficient power must be lodged in boards or health officers. The result of the order to me from our state board of health, in ridding the people in about two and one half months of small-pox, demonstrates at once its wisdom and utility, and is an assurance that to such organizations the sanitary interests of the states ought and can safely be entrusted. I agree fully with the distinguished sanitarian of Washington, D. C., Smith Townshend, M. D., as to the management of this disease, when he says, "An efficient health department should stamp out the disease within, at farthest, four times its incubatory period."

If I shall have succeeded in calling the minds of sanitarians to pause for a time upon the importance of securing by legislation ample powers for the health departments of this country, to whom it chiefly belongs, to the end that the people may be protected from the desolation of plagues, I shall feel that the full object of this paper has been attained.

XXXV.

HARDSHIPS OF THE COASTING TRADE, AND PARTICULARLY OF THE CHESAPEAKE BAY OYSTERMEN.

By W. WYMAN, Surgeon U. S. M. H. S.

"Man's inhumanity to man makes countless thousands mourn." Inhumanity in time of war, history has taught us to expect; but inhumanity in times of peace, and exhibited in the ordinary channels of trade and commerce, may well excite surprise, and should arouse effective protest. Ocean commerce was, at one time, marked by brutal treatment of the common sailor, disregard for his proper food, clothing, and quarters, and utter indifference to the seaworthiness of the vessel in which he sailed. This condition has been greatly changed in modern times, and the deep sea sailor has now upon his foreign voyage great protection from the law. In the ocean coasting trade of the United States, which has grown to enormous proportions, my observations lead me to believe that the ordinary seaman has no great cause for complaint. I speak only from examination of the steamers and sailing vessels that come to Baltimore, and particularly of the latter class, notably increased in the past few years by the addition of many large three- and four-masted schooners, upon which the sailors live as well as sailors may expect to live.

But, turning from this satisfactory contemplation, we find its contrast where least we should expect it—in inland navigation—upon bay and river, on vessels which rarely lose the sight of land, whose voyages are but seldom perilous, and whose daily passing and repassing make them familiar objects to our sight. On the very river which flows before this city, and on its great tributary, the Ohio, there are enacted, each winter, scenes of injustice, abuse, and exposure, which, were the subjects but of a higher social grade, would arouse a storm of public indignation. Floating upon these rivers to-day are vessels which in a few short weeks, when the cold waves come from the north-west, and ice and wind and sleet prevail, will present upon their lower decks the spectacle of men, white and black, scantily clothed, seeking in vain for place of shelter and protection, and to avoid the disease and suffering which this exposure will surely bring. Many steamers of a certain class upon these rivers—the stern wheel, combined passenger and freight boats—have no provision whatever for the housing of their deck crews, who, when the chance protection afforded by the freight is gone, must either freeze, or crawl beneath the boilers, there to suffer an opposite but equally dangerous extreme. I speak after three years' observation of boatmen in St. Louis, and three more in the city of Cincinnati, and for detailed proof may be

pardoned for referring to a paper prepared on this subject by myself, and published in the *Cincinnati Commercial* of March 5, 1882, and later in the annual report for '82, of the surgeon-general of the marine hospital service.

I shall not now pursue this matter further, but refer to it at this time in order to keep it alive, and because in the following lines is exhibited a somewhat like condition upon Chesapeake bay. I have some hope that the combined mention of both classes of hardships, those of the river and the bay, in the West and in the East, may excite more thoughtful attention than would their individual consideration.

A noble body of water is Chesapeake bay. Entering Virginia between Cape Charles and Cape Henry by a channel twelve miles in width, it spreads upward into the heart of Maryland for some two hundred miles, with an extreme breadth of forty miles, and a depth sufficient to permit the largest ships to ascend nearly to its head. The region drained by this great bay and its tributaries embraces an area of seventy thousand square miles, with a population of over two millions of people.

The most important industry on this bay is the oyster trade. It is said that one hundred thousand people in the state of Maryland are dependent on the oyster production; that three hundred thousand people in the same state get their living, directly and indirectly, during the winter season, from the oyster business, and that capital is invested in it to the amount of twenty millions of dollars. Last year there were gathered in the waters of Maryland (Chesapeake bay) twenty millions of bushels of oysters, worth, on an average, forty cents per bushel, or a total value of eight millions of dollars. From the report of the Maryland oyster commission, I learn that the area of the Maryland oyster beds is 578,224,000 square yards. That is to say, Maryland has at the bottom of Chesapeake bay one hundred and ninety-three square miles of natural oyster beds. Yet only a small proportion of the bottom which is proper for oyster farming is now occupied by these natural beds, and the total area of valuable oyster ground is safely estimated at six hundred and forty thousand acres, or one thousand square miles. Much of this ground, it is said, could be made to yield, by cultivation (oyster farming, as it is called), an annual profit of one thousand dollars per acre; while the profit of the whole one thousand square miles under proper cultivation would average one hundred dollars per acre—an annual profit of more than sixty millions of dollars.

It has been estimated that this and other bay industries are capable of being carried beyond the production of the soil of the state. No other state and no other body of water can compare with the state of Maryland and Chesapeake bay in both present and prospective oyster production. There are some small towns on the bay, such as Oxford and Crisfield, that owe their origin and existence to the oyster trade alone. Crisfield, for example, has almost an oyster shell foundation, the formation on which many of its houses are built being a solid area of ten acres of oyster shells with a depth ranging from four to eight feet. The shells are also used

in building roads, for making lime, and are used by neighboring furnaces, with great saving of expense, as a flux in the manufacture of iron.

Oysters are gathered by two distinct methods, known as tonging and dredging. The former is carried on in shallow water by means of small row boats. With the tongmen this paper is not concerned, excepting to show their relation to the dredgers, who, by a law made in the interest of the former, are forbidden to operate in certain waters, generally near the shore. The law also permits the tongmen to work during a longer season, viz., from Sept. 1st to April 15th, while the dredgers are restricted to a period shorter by two and a half months, or between November 1st and April 1st.

Dredging is the principal and deep-water method of taking oysters on Chesapeake bay, and is conducted by means of sailing vessels—small schooners, which may with propriety be described at this point, since it is on these schooners that the oystermen live and meet the injuries and diseases about to be narrated.

The schooners are of two varieties, known familiarly as the "pungy" and the "bug eye," and despite these homely names are graceful in outline and design; and in the summer season, when they are used to carry fruits and vegetables, they add considerably to the picturesque character of this beautiful bay. The pungy is the larger and more common vessel of the two, varying in tonnage from five to one hundred, with an average of thirty or forty tons, and drawing about four feet of water when loaded. The hull is flat bottomed, but sharp at both ends under water, with a broad deck fore and aft, and the deck made square at the stern. The vessel sits low, for the closer the deck is to the water, the less labor there will be in lifting the oysters over the side. For this reason, also, there is no bulwark, but only a rail. They carry two masts, a foremast and a mainmast, and sometimes, while running, a very large maintopmast staysail. These pungies are very fast, make but little leeway, are provided with centre-boards, and can sail within four points of the wind. The hold is arranged for storing oysters, which are dumped into a large hatchway about amidships. Two other hatches open respectively into the captain's cabin aft, and into the men's quarters forward in the fore peak.

The captain's cabin, which accommodates himself and the mate, is diminutive in size, having a square area of only four or five feet, and about the same height. It contains a small stove, and has opening into it one or two horizontal recesses, used as bunks. The same general arrangement exists at the forepeak, excepting that the quarters take the shape of the bow of the boat, and the space per man is relatively less.

The "bug eye" is of different shape, being sharp at both ends, both above and below the water, "a flat bottomed centre-board schooner, of three to fifteen tons, built of heavy timbers without a frame," with the rig also occasionally different, consisting of leg-of-mutton sails. They, too, are very fast, and can sail closer to the wind than a pungy.

There are at least one thousand of these larger oyster schooners, and a

fleet of more than five hundred of the smaller size, upon the waters of this bay, carrying, on an average, a crew of six men to each vessel. Some of these remain at the oyster bed a whole season without coming to port, and are known as "lay boats," their loads being transferred to others known as "carriers;" while a few do not dredge at all, but purchase from the others, and are called "buy boats."

Time will not permit the reading of a full description of the dredging vessel's armament—the dredge and the windlass—but the dredging process, as described in the U. S. Census Report, may prove of interest:

> "When the boat reaches dredging-ground, the captain takes the helm, and the men prepare for their laborious task. The dredges are thrown overboard, and the vessel continues on her course until it is supposed that the dredge, which usually holds two or three bushels, is full, when it is hauled up, and its contents, consisting of oysters, shells, crabs, fish, &c., are emptied on the deck. If the vessel has passed across the bar, she tacks, and recrosses the grounds, and continues sailing over the same ground for hours.
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> "If dredging is done in the day-time, the oysters are at once 'culled,' but when working at night, this is deferred until morning. 'Culling' consists in separating the oysters from the other things brought up by the dredge, and throwing the latter overboard, while the former are placed in the hold of the vessel."

As soon as the vessel is loaded, she proceeds to market, where, in the packing houses, large numbers of men are engaged in opening the shells and canning the oysters for shipment.

The crews of these vessels gathered in the cities are of a motley character; some of them colored, a few criminals, and many of them but recently arrived foreigners,—Swedes, Norwegians, German peasants, and Bohemians, scarcely able to speak the English language.

When an oyster captain wants a crew, he generally seeks the aid of a shipping master, who, from the sailors' boarding-houses and other resorts, will secure the required number at a charge of two dollars for each man, which sum is subsequently deducted from the men's wages by the captain.

But a less reputable method, when haste is required or labor is scarce, is known as shanghaiing. To shanghai is simply to kidnap, and carry a man aboard the vessel against his will. Generally, the shanghai is first induced to drink to intoxication, or is drugged, and while unconscious is taken aboard the vessel, to find, on awaking, that he is down the bay beyond the reach of help.

I have an article too long for reading, taken from the *Baltimore American* of January 9th, of the present year, headed "A Modern Press Gang," and asserting the existence, in Washington and Baltimore, of regular press gangs employed to kidnap men for the oyster fields; and narrating the specific case of one man who, under promise of engagement on a large steamer, was induced to go out in a small boat to meet her. The man was taken to an oyster vessel instead, and carried down the bay to the oyster beds, where he was compelled by the most cruel treatment to work at all hours and in all weather, sick or well. He only escaped by jumping overboard and swimming ashore, and on reaching

home gave a heart-rending account of his cruel treatment, and the information that others likewise pressed into the service were there, unable to get away.

The captain of a schooner carrying one or more kidnapped men is quite able to bully a maximum amount of work out of his unwilling help. Stern natured, with great determination, and hard fisted, he is the congener of the mate upon the Western steamboat. Many of them may be kind in disposition and averse to violence, as are many Western mates; but a large number are capable of the greatest brutality, and I have heard it freely asserted by men who should know, that many a dredger has been knocked overboard and drowned by an angry captain, because dissatisfied with his work, or to avoid the penalties to which the kidnapped man might subject him on return to port, or to stop a troublesome demand for wages.

In speaking more specifically of the diseases and injuries to which these men are liable, the fact must be borne in mind that dredging is carried on in cold weather only, or between November 1st and April 1st, and that the men's labor is all upon the open deck, where their clothes may be kept wet and frozen by the spray, or by handling the dredge, and "culling" oysters.

Under these circumstances, even if well clothed, it would be strange if pneumonia and rheumatism were not frequent among them. What then can we expect, when it is known that very many of them are taken to the oyster grounds scantily clothed, and with no special preparation for the wet, cold work in which they must engage.

There is a law requiring every deep sea vessel to carry a suit of woollen clothing for each sailor in the crew, but no law compels an oyster captain to look thus to his men, nor prevents his shipping them half naked, though he knows the suffering to which they will be subjected. * * * At night, when generally work has ceased, the dredgers retire to the narrow fore peak, and there lie down around a little stove, which, kept at white heat, dries their clothing while on them. But should one of them be sick, and unable in the morning to leave the fore peak or his bunk, the rest being forced to abandon him for their work, and kept too busy to return, the fire goes out, and all day long, and perhaps for many days, that sick man lies without a fire to protect him from the severities of a winter season upon the open bay. This has been the oft repeated story of many who have come to the hospital with rheumatism and pneumonia. One of the most common results of this exposure is frost-bite.

I have the record of fifty patients from these oyster vessels alone, who, during the past two brief winter seasons at Baltimore, have been treated in hospital for frost-bites; and many others of less severity were treated at the dispensary.

A very serious matter to the dredger are the wounds upon the hand received from the oyster shells, generally during the process of "culling." Whether there is some peculiar poison in the shells, or in some substance that is brought up with them, or whether the wounds are aggravated by

the cold, I have not determined; but certain it is, that the hands swell, both on the palm and back, to an enormous size, and the whole arm may enlarge in spmpathy to the shoulder.

I have the record of some thirty of these cases of varying severity; and so common are they, and so characteristic in appearance, that they have received in hospital a specific name,—The Oyster Shell Hand.

Again, there are various accidents to which these men are subjected, which may be grouped under three general heads, viz.:

Injuries from falling;

Injuries from foreign bodies; and

Injuries received from the crank handle of the dredging machine, to which latter are due the large majority of the fractures mentioned. This machine for hoisting the dredge cannot here be described in detail; but the arrangement is not unlike the ordinary windlass of a well, excepting that it is made wholly of iron, and has two handles instead of one. This machine, simple as it looks, is a murderous instrument, and works untold havoc, wounding and permanently disabling dozens of its victims every winter, and occasionally causing their death.

It is to this deadly instrument that I would call more earnest attention than to all the combined hardships before enumerated. The story of its method is briefly written, but the story of its victims can never be told.

I have already described the dredge itself, and the vessel, and method of dredging. We may now suppose ourselves a spectator on one of these vessels. The oyster grounds are reached, the sails are set, the captain is at the helm, the vessel goes bounding over the water, and the dredge thrown overboard drags along the bottom. Presently the line is taut, and two men slowly wind at each handle of the windlass, for the dredge is heavy, and its weight is increased by the resistance of the water, through which the vessel sails with unabated speed. Four men are slowly revolving the handles, when suddenly and without warning, as though an angry Titan had grasped the rope, a check is felt upon the ascending weight, the dredge rope gives a vicious jerk upon the spool, the spool reverses like a flash, and with it the iron handles revolve with terrific velocity, torn from the hands of the men as though they were made of straw. What has caused it?

While still suspended in the water, and the schooner under full way, the heavy dredge has struck a piece of wreck, or projecting ledge of rock, which is technically known as "catching on a hang." But what has become of the four men who, but an instant before, were turning at the crank? There in the bay is one, tossed through the air, over the vessel's side, into the icy water. But his bath is insignificant. His limb struck the rail as he went over, and he has a broken leg.

Here is another just regaining consciousness, with an ugly wound upon his scalp.

The third may have escaped. The fourth one leans against the hatch, where he was thrown with violence, and has three fractured ribs, with laceration of the lung.

The above are not supposed cases. They are but moderate selections from recorded histories in my possession. Were it needful to make the scene more vivid, reliable testimony could have been added to picture one as killed outright, and another with injuries inflicted that proved fatal a fortnight later.

To prevent these accidents, devices have been invented and patented, by means of which, when the obstruction is met, the handles are thrown out of gear, and remain still while the spool revolves. Nearly all oyster vessels carry these patent attachments, and doubtless but for this precaution there would be greater loss of life. But they are all liable to get out of order and fail to work, or may break under a very heavy strain. All the cases above reported happened upon vessels supplied with these patents.

Let me narrate in detail just one case, to show the misery created by this crank handle. James Belfield was a man about forty-five years of age, five feet nine or ten inches in height, of fine physical proportion, and beautiful muscular development. November 14th, '82, he was in employment on the schooner Kent Island, engaged in oyster dredging on the Chesapeake. The vessel was under all sail, and Belfield, with others, at the windlass winding up the full dredge. Presently an obstruction was met, the dredge caught upon a "hang," the patent slipped, the crank handle rapidly reversed, and striking Belfield in the abdomen, hurled him backward with terrific force against the hatch. Although, as subsequently proven, he sustained a fracture and dislocation of the spine, for two weeks he was compelled to lie in the cramped and cold quarters of the forepeak because it was deemed more important to get a full load of oysters than to convey this man to where he could receive speedy medical treatment.

On being brought to hospital, the patient's condition is that of paralysis in both legs, the result of the fracture and dislocation that are readily made out. He is unable to walk, and complains of a cold feeling extending from his chest to his feet, and has scarcely any sensation in his legs. The site of the wound is tender and painful: for several days he suffers great pain in the abdomen. Later he spits blood, complains of gaseous distension, and has the girdling sensation around the waist. With alternate improvement and relapses in his symptoms he lives on from month to month, now feeling much better, and buoyed with the hope of ultimate recovery, now again suffering his pains with all the worst symptoms more aggravated than before, retaining activity of brain and mind in a useless body. For eight months he lies in my wards, and is then transferred to special quarters provided for incurable cases like his own.

The future of this man is read by the experienced physician as though it were an open book, and an overpowering feeling of sadness fills the soul at the sight of this once active man;—a man who still eats and drinks, smiles and chats, but whose limbs hang limp and helpless; whose remaining powers are fleeting with the season; who greets each morning sun with somewhat less of hope and strength, and in the waning

of each day feels the presage of his fate; who now sits in a reclining chair, and, from his window, with a forced calmness, looks out upon the active world, from which he is withdrawn forever; who to-morrow, or after a few morrows, will be denied this pleasant window vision, and be forced to limit his gaze to the whitened ceiling overhead and the cold walls of his ward, and within whose mental horizon the daily meals and the hour of darkness will be of chiefest import because they measure off the passing of the weary time; who will then grow wan and feeble, and whose emaciated body will wear away the skin at the parts which rest upon the bed; who soon will *care* for neither food nor drink, and awaits the coming of his doctor, no longer with any hope of rising, but to be relieved for a short period by the anodyne; who finally, with hollow cheeks and protruding eye, with red flesh pushing through the gangrenous skin, will tax for many days the patience and the sympathy of his attendants, and only after weeks of misery be relieved by death.

A history that need not have been.

Now if this man had been injured while performing some deed of heroism, such as makes conspicuous the soldier, or in civil life the fireman, or if his injury was the result of some unlooked for and exceptional disaster, one element of regret would be removed in the contemplation of his case. But there is the added bitterness that this unlucky day on which "the patent broke" was but a day pointed to by the hand of probability; and that amidst all the wealth and intelligence displayed in this great oyster industry of Chesapeake bay, no modicum thereof is directed toward removal of this danger to life and limb of men whose labor is indispensable.

We may now pass in rapid review the various features of the oysterman's life as portrayed above. We have seen that under false pretence of other work he is decoyed; or, first plied into unconsciousness with liquor and with drugs, is bodily dragged on board the oyster schooner, and with waking realization finds himself in the middle of the bay, far from land, with none to call upon for help; that in a situation which demands the warmest garments, he is thinly clad, and suffers an exposure which results in frozen limbs and serious diseases; that slippery decks, and clothing stiff with frozen spray, cause heavy falls and fractured bones; and that by many days' detention and neglect, both injury and disease are greatly complicated.

Wind storms and floes of ice bring shipwreck, exhaustion, or a watery grave. The hand of the brutal captain is laid in violence upon him, and with intent to defraud him of his wages; and by a reckless captain he is forced to either violation of the law, with risk of bullets from the state and county guardians, or to brave his captain's persecution, and a charge of mutiny. Neglected wounds from oyster shells poison hand and arm and blood, and, after painful course, leave loss of function in the fingers, or of the fingers themselves. And, finally, that in an instrument placed within his hands to draw a table luxury from the bay, he finds an instrument of injury and of death.

Let us have no unnecessary or false sentiment. Many of these hardships are the unavoidable result of this business from its very nature; but we shall not be visionary or impractical in expressing the opinion that several of these worst features are preventable. Surely the state of Maryland might demand at least of every captain who plies within *her* waters that no half-naked men shall be found working on *his* deck; and that no sick man, beyond a given time, shall be allowed to lie in the miserable forepeak, but shall be promptly carried to the nearest port, where relief may be obtained. And let us not forget the fleet of three steamers and eleven sailing vessels with which a demand like this might be enforced.

And surely human ingenuity can supply, and a commission could be appointed to recommend, a safe substitute for this deadly windlass, which, used, as I believe, on Chesapeake and Delaware bays alone, should be swept by law from the deck of every oyster vessel.

This, then, is the winter's tale of Chesapeake bay. The traveller who, on pleasure bent, in the golden days from June until October, sails over its two hundred miles from the Patapsco to Hampton Roads, with mind diverted by its historic memories, and vision charmed with its kaleidoscopic scenes, little suspects the shadows which the next few months will throw upon the pleasing picture,—a picture that, with all its light and shade, has a fitting companion piece upon the Western rivers.

It is not within the province of this paper to suggest remedial measures for these wrongs, or make inquiry concerning the relation in which these men stand to state and national statutes. It is enough at one time to present the facts. These men, unlike other laborers, have no protective unions, no mutual aid societies, no political influence, and make no protest. Though large in number, they are helpless.

But there exists in congress a committee on commerce, with a subcommittee on the treatment of seamen (and all these men are seamen, as defined by law), to which the subject might with propriety be referred. Surely with the existing perfect machinery for governmental supervision over navigation, it would require but slight extension of this power to enforce a proper housing of the deck crews upon Western steamboats; to require sufficient clothing for the men who ship on oyster vessels, and the substitution of safe for dangerous instruments of labor.

Nor is any argument required before an association such as this, to show the inter-dependence of all classes of citizens in regard to public health. No community can afford to indulge an indifference to the sufferings of its most humble members: for, both in a sanitary and economic sense, this indifference will react with force upon the body politic.

In matters of health, there is no choice but to be our brother's keeper.

XXXVI.

SANITARY CARE IN STOCK TRANSPORTATION, IN THE PREVENTION AND CONTROL OF TEXAS CATTLE FEVER.

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In presenting to you the few observations and suggestions on the dread pestilence among our cattle, commonly known as Texas, Spanish, or Splenic fever, it is not my purpose to enter into any extended history, nor offer any special suggestions in the way of treatment, save those that will best subserve the rigid enforcement of sanitary laws for the successful prevention and control of the disease. The existence of Texas fever can no longer remain a doubt. The loss of untold thousands of dollars in property interest to our Northern stock-owners by its ravages, only too certainly traced through the tens of thousands of cattle afflicted, in every instance to the stock imported from Southern ranges; the thousands of square miles of territory annually invaded; the growing prejudices and irresponsible quarantines established by communities to serve as barriers in restricting the traffic and transit of Texas cattle, thereby seriously depressing and threatening total disaster to the trade,—are proofs conclusive, and enduring evidences, of the reality of this plague. When the farmer's attention, which so frequently happens, is called to the fact, through some mysterious hidden cause, that his cows hold up their milk, seem listless, indifferent, off their food, and feverish, with drooping head, lopped ears, humped back, and other alarming symptoms characteristic of some grave disorder, proving eminently contagious, and rapidly fatal, frequently destroying from one half to two thirds and sometimes the entire herd in the short course of time, the question naturally suggests itself, to search for the cause and find a remedy to stay its terrible desolations. In this emergency, the farmer and stock-dealer, anxious for a cure-all, are only too eager to grasp at every prescription and nostrum advertised. Whilst laboring under the erroneous idea, fostered by quacks and charlatans, that experimentation will reveal a specific remedy for every disease, and that medical science has nothing to do but label each disease, and to search for specifics which do not exist, the best and most scientific prescription can be of but little avail; and a rational and successful treatment, and, still more, the prevention and control of the disease, are rendered an impossibility without the knowledge of its nature and cause, and the rigid enforcement of certain hygienic laws, which are as applicable to the preservation of the health of the lower animals as they are to the life of man.

After a careful and thorough research and investigation into this malady, it is contended on the part of scientists that the disease is epizootic in nature, contagious as to members of the same herd, and rapid in progress; that Texas cattle are invariably afflicted with it upon their native ranges; and that they carry the disease to foreign pastures, as ships carry contagious disease to foreign countries, even though no case ever occurred on board. They carry the disease germs in their hair, in the stomach and alimentary canal, and they are communicated to our Northern hoofs, even though weeks have elapsed since Texas cattle passed over the trail; whilst, on the other hand, it is contended by the owners of Southern ranges that the disease has never been recognized among their hoofs; indeed, that Texas cattle are wholly exempt. But be this as it may, the facts remain, and are indisputable, that the germs have their origin and are propagated among them, and are communicated to our Northern hoofs; and the problem, how to combat the Nemesis which threatens disaster, and total exclusion of such cattle from our Northern markets, and do justice to all interests and the capital invested,—burdened with all its complexities and disagreeable intricacies,—must be left, sooner or later, to sanitarians and political economists, through wise legislation, to solve.

Texas and other Southern plains must always remain the nursery or breeding-grounds for our beef cattle; whilst Colorado, Montana, Wyoming, Nebraska, and other Northern states, will furnish the grazing and maturing ranges. Of late years great changes have taken place, owing to the influx of immigration into the state of Texas, which has caused the fencing of farms and ranges to such an extent that the herding, maturing, and driving of cattle through the state is rendered almost an impossibility: hence the immediate transportation of stock through the facilities afforded by railroads, now reaching all parts of the country, necessitating the subjection of the cattle to all the hardships, abuses, and deprivations incident thereto, before reaching their destination, in preference to the old and reliable way of slow driving and herding in small herds, more fully accounts for the recent dissemination of the disease into the extreme Northern states, and has brought about the discussion of the feasibility, to avoid the possibilities of irresponsible quarantines and state interferences, of establishing a national highway or trail, with the average width of ten miles, up through the Pan-Handle of Texas, that yearlings may be driven in such herds and with such care and strict observance of sanitary regulations as to avoid the possibility of transmitting the fever into the maturing ranges of the more northern territories, where the cattle thrive, and become dispossessed of the power of communicating the disease in transit to our Eastern markets.

While the above scheme has many advantages and ardent supporters, there are so many insuperable barriers to be encountered in its successful consummation, owing to the right of adjoining states to legislate their own affairs, that without their full coöperation the establishing of a national highway or trail is seemingly impracticable: nor can these difficulties be

overcome and the desirable object accomplished, until cattle-men learn and realize the importance of a rigid application and a thorough dissemination of sanitary laws, which will not only subdue the already existing but fast growing prejudices, but must of necessity enhance the value of their stock; but owing to the constantly increasing demand for beef cattle throughout the country, and our Southern and Western ranges being the source of supply and must always remain so, the laws of commerce naturally seek the most available facilities to meet the markets. The system of slow driving and grazing has been almost totally superseded: hence the possibility of bettering the condition of affairs, in shipping by rail, must receive a more rigid attention.

The question of establishing a particular date, as is proposed by the "Commission of Animal Industry," for the shipment of Texas cattle, to begin when they would not be liable to disseminate the disease germs, is rendered impracticable from the fact that the herds cannot be shipped in winter, nor until after the first spring months, and after they are in a fattened condition for market, which necessarily confines their transportation to the season most dangerous to the propagation of the disease. Therefore the problem resolves itself into one of two things,—the establishing of abattoirs in the vicinity of Southern ranges for the slaughtering and shipping of all dressed beef in refrigerating cars, or the enactment by each state of stringent sanitary laws and the rigid application and enforcement of the same, and to maintain a healthful condition of the cattle in transit.

The number of animals, now shipped annually from the ranches of the great Western and Southern states and territories to the great cities of the interior and seaboard, is enormous. The distances traversed are so great, that the journey, under favorable circumstances, would be attended with the most insuperable hardships: as actually performed, it is accompanied by extreme suffering for want of food, drink, and space. At the place of loading they are driven aboard the cars, into which they are packed and crowded with blows and thrusts from their brutal drivers; and if any lag behind or refuse to enter, they are prodded with iron spikes sharpened so as to penetrate the flesh and give intense pain.

The time consumed in making the passage is from three to ten days, and frequently, owing to delays of trains, still prolonged. What must be the agony, from hunger and thirst, of the poor brutes under such circumstances, especially when exposed to the heat of midsummer, in the sight of green fields, and rivers, and lakes, of which they are not allowed to partake! Notwithstanding the wholesome law enacted by congress to protect animals during transportation, which requires that all animals shall have five hours' rest after every twenty-eight hours' confinement in the cars, and in this interval shall be driven into an inclosure provided for that purpose, where they can move about and be fed and watered, the eagerness of the shipper to meet the full tide of the markets too frequently assumes the risk regardless of the dictates of humanity, foregoes the law, and passes by the station. It is a common occurrence for

cattle to be shipped from the city of St. Louis to New York with but a single rest during the entire journey. Then, again, trains are often delayed, and remain side-tracked for hours ; and the law is again ignored by the railroads, and the relays passed to make up for lost time, and the cattle, as a consequence, are allowed to suffer untold agonies. Is it any wonder, under such circumstances, that they are in a fit condition to propagate disease? Who can contradict the danger and the assertion that such cattle are totally unfitted for health-giving food-supply? The laws of humanity, and the cruel and demoniacal brutality, better imagined than described, which these poor beasts are subjected to—if not the sanitary prevention of the many fatal diseases in man, too certainly traceable to the consumption of diseased animal food—cry out and imperatively demand reform. It is useless to deny the existence of such a state of affairs. It is useless to contend that the law of supply and demand regulates and justifies the end, and that necessity recognizes no mercy. It is true, the enactment and rigid application of stringent laws at first would apparently entail some hardships, and might prove oppressive to cattle-dealers ; but the salvage in loss, by shrinkage in weight, death, and injuries incident to the reckless manner of transportation as now conducted, with the general improvement of the condition and health of the animals delivered in the markets which must necessarily follow under any system of reform, will not only counterbalance the ill effects first experienced, but will greatly enhance their value, restore confidence, and in time assuage all fears of the terrors and dangers of the importation and transit of long-horn stock.

To bring about this most desirable result, it would necessitate a united coöperation in the rigid enforcement of the laws in existence, and the enactment of such other measures, by the various states, as would tend to maintain a strict and rigid surveillance over the sanitary conditions of the cars, in the loading and unloading, and in the general condition of the cattle in transit. In the furtherance of this it would be advisable for the different states to delegate the powers of quarantine to competent and constituted authorities, and establish corps of inspectors along the lines of transit whose duty it should be to see that the cars and relays, or resting-pens, are kept thoroughly cleansed and disinfected after every loading and shipment ; and they should be vested with full power to enforce the laws, and report all infringements and violations to the authorities for prosecution. Under no circumstances should the cars be overloaded and the cattle remain too long together, since the disease among the animals on their native ranges is of such latency as to render its existence questionable. The overcrowding, the breathing and rebreathing the same air, causing "crowd poison," together with the deprivations and constant mutations and physiological perversions endured by the animals in transit, may be sufficient for the generation of the germs, if it is not their absolute cause *per se*. At all events it renders them unhealthy, and undoubtedly contributes greatly to the propagation and wide dissemination of the disease. Railroad companies should be compelled to look after

the sanitary condition of their trains, and contribute more attention to the careful handling and transportation of cattle, and at least furnish some of the necessities the laws of nature and humanity demand. The animals should be shipped at proper intervals, with food, plenty of room, and fresh air, and watered frequently. And for this purpose it would seem practicable for the companies to place troughs in every car, to be flooded at the tanks at least as often as the engines require water. The relays or resting-pens should be frequently cleansed, and all unsanitary accumulations promptly removed and disinfected. The cattle should be daily inspected, and all those which are diseased, injured, and broken down should be strictly isolated, and retained until thoroughly recuperated before proceeding on the journey.

If Texas fever has made its appearance among Northern herds, the same rigid application of sanitary measures—the strict isolation of the sick, and separation of the cattle into small herds, the change of pasturage, and the feeding of "ensilage," or succulent food such as green corn, turnips. and pumpkins, as is proven by the experience and timely suggestions of Maj. John S. Mellon, of St. Louis—is both beneficial and curative, and is our only hope and best remedy for the prevention and control of the dread disease.

The enforcement of such a system of sanitation, in these days of speculation and eagerness for the accumulation of wealth, seems overwhelming, impracticable, and oppressive; but the time must come, sooner or later, with the growing prejudices, together with the property interest involved, and the earnest demand for a better sanitary control of food-supply, when the enforcement of such measures will become imperative. Then, and not till then, will the dread of the importation of long-horns and Texas fever be shorn of its terrors.

XXXVII.

ON THE DURATION OF INFECTIOUSNESS IN SCARLET FEVER.

By W. W. VINNEDGE, M. D.

Lafayette, Ind.

It may be taken for granted that we are all of one mind as to the desirability of imposing some artificial check on the spread of scarlet fever. Some are of the opinion that measures of prevention are not sufficiently rigid and prolonged to effect the greatest amount of good. Few persons would hesitate to separate a child with sore throat, strawberry tongue, red rash, and a high temperature, from his playmates; but with the disappearance of these symptoms, many would regard as past the necessity for further isolation and disinfection. This, according to recent authority, would be a mistake, since the period of infection does not terminate with this stage of the disease. For the sake of clearness in the discussion of this important subject, I beg to glance at the general characteristics of the malady.

In comparison with other diseases, scarlet fever "is remarkable for the diversity which it presents in different cases, as regards symptoms and fatality." Some persons throughout an attack experience but slight constitutional disturbance, and are able to move about without inconvenience to themselves—and yet the severest accidents may follow a mild seizure; on the other hand, the attack may be violent from the beginning, and result in death after an illness of only a few hours; and again, during the continued intercourse of people with each other, some individuals who live under the same conditions with the sick, will escape contagion, while their neighbors receive the infection and suffer or die of the disease.

The variable character of epidemics, as well as the irregularity of symptoms in individual cases, has sometimes led to hasty and inaccurate conclusions as to the gravity and infectiousness of the malady. The fact that it is self-limited and liable to be variable in its manifestations renders its study somewhat unattractive to scientific minds; and, owing to the frequent comparative harmlessness of its attacks, the public, in many instances, become indifferent to measures of prevention, and many persons are exposed to suffering and danger, and the state to expense and loss.

According to recognized authority, scarlet fever is an acute, infectious disease, characterized by fever, a finely diffused redness of the skin and mucous membrane of the upper throat, which, if the patient survives the

attack long enough, terminates in a peeling of the skin. Prof. Bartholow says,—

> It is propagated by a peculiar poison, which by reason of the tenacity with which it adheres to articles of clothing, and other peculiarities, we have good grounds for holding is a solid. It is communicated by contact of the healthy with the infected, and by the intermediation of various substances to which the poison adheres. It occurs both in the sporadic and epidemic form, but it never arises spontaneously. The susceptibility to scarlet fever is by no means universal, and the time which elapses from exposure until the objective signs of the disease are manifest varies greatly: it may be stated to be from a few hours to fourteen days.

The very slightest contact with the morbific principle is sufficient to infect, and it is conveyed to the susceptible in very many different ways. It may be carried on or about the persons of the healthy—in the clothing or on the surface of the body, or under the finger nails—to others at a distance. "That it may be dissolved in articles of food or drink, and so conveyed to the unwary, seems to be pretty well demonstrated by epidemics following in the wake of milk distribution." The disease is generally disseminated by the skin and its excretions and epithelium, and by the breath and exhalations from the throat.

Wherever scarlet fever spreads, children are its chief victims, those between one and five years of age being most exposed to the disease, while the seizure-rate among children between the ages of five and ten years is little, if any, lower in number than it is in the younger class.

Adults and infants are not so susceptible to attacks of the disorder. Thus, it will be seen that the period of the greatest susceptibility is during or near the school-going age. "Taken generally," Quain observes, "the proportion of deaths to attacks must be near 10 per cent.; nor is the death-rate less in non-epidemic years." Bartholow estimates that the mortality in different epidemics varies much,—from 10 to 40 per cent.,—being controlled by the type of the epidemic and hygienic surroundings of the sick. Out of 817 cases reported in Indiana for the year ending Sept. 30, 1883, 114 deaths occurred,—a death-rate of a little less than 14 per cent. The secretary of the Indiana State Board of Health estimates that "not more than half of the deaths are embraced in this report." But a sufficient number are recorded to show that during a year of excellent general health, and freedom from a general epidemic of this disease, the disorder was abroad doing its baneful work. Even this hurried glance at statistics is sufficient to impress the casual observer of the vast importance to the public of the most pains-taking applications of effective measures to prevent the spread of such a deadly disease.

The diversity of the signs, especially the early symptoms of scarlet fever, greatly increase the labors and responsibilities of the physician in his relation to the public. If the doctor hesitates about naming the disease in a given case, parents often conclude, and act upon the conclusion, that it is not scarlet fever, and thus, by impatience and indifference, the susceptible are exposed and the malady is disseminated. Again: If parents, teachers, or physicians permit convalescent patients to mingle

with the unaffected too soon, the disease is almost sure to be communicated to others, and the health and lives of many exposed to danger. On the 27th of April last, a family composed of father, mother, and four children, changed their residence from Saybrook, Illinois, to La Fayette, Indiana. The day after their arrival, the second child in the order of ages, a girl eight years old, was seized with scarlet fever, and I was called to see her. The father and mother, persons of good intelligence, could not at first recall that any member of the family had had an opportunity to contract the disease. During my second visit, they stated incidentally that a few days before they took leave of Saybrook, a neighbor girl, a friend of my patient, had called to see her, and this child, who was convalescing from scarlet fever, was peeling. This, I explained at once, was doubtless the source from which their daughter obtained the disease. My patient's brothers and sister were, with one exception, unprotected by a previous attack of the disease, and, I may add, did not escape the malady.

A still more striking case, illustrative of the ignorance of the public as to the infectious character of the disease during the stage of desquamation, was, a few months ago, related in my hearing by Dr. Moulder, of Kokomo, Indiana. A child, either a patient or an acquaintance of his, suffered a severe attack of scarlet fever, and recovered; during desquamation, the epidermis of the hands, with finger-nails attached, was stripped off almost entire. These specimens were carefully preserved in a small paste-board box by the mother of the child for months afterwards, and at intervals were brought from the garret and shown to curious friends. In due time Dr. M. learned of this, and very promptly and properly recommended that the morbid specimens be burned, telling the woman that they might under certain conditions become exceedingly dangerous.

A difference of opinion as to the infectiousness of scarlet fever during the stage of desquamation is not confined to the lay portion of the public. There is a diversity of views on this subject in the medical profession, as well as some uncertainty of teaching, in at least some of the text-books. I think I can best present this branch of my subject by reproducing an interesting correspondence published in *The Lancet* (vol. 1, p. 280, 1881), and which was begun by a non-professional gentleman, an Englishman, under date of February 5, 1881, addressing the following communication to the editor of that journal:

My son is at a large public school near London. He was to have returned home for his Christmas holidays on the 20th of December last, but on the 19th of December I received a letter from the head master, saying that on the previous day (Dec. 18th) he was found to be suffering from scarlatina, and, very properly, had been placed in the infirmary attached to the school, and of course could not be removed. I proceeded to the school at once, and saw the medical gentleman attending him, who informed me that the attack was unusually light, that there was an entire absence of fever, and that it was with the greatest possible difficulty he could detect any eruption. To my surprise I received a certificate from his medical attendant on Dec. 29th, stating "that my son might be permitted to join his friends on Saturday, the 8th of January, without the slightest risk to any one." Notwithstanding this very decided opinion, I followed the advice of medical

friends, and considering that the 8th of January was only three weeks from the date of the attack, and the other members of my household never having had this fever, I removed him to the sea-side, and placed him suitably. On the 26th of January he was to have returned to school, and on the 24th being at the same place where he was staying, in consequence of some representations made by the matron of the house he was in, I requested a very experienced and conscientious medical gentleman to inspect him and report to me his condition. Having done so, he told me he was actually peeling, and, of course, in an infectious state, and he confined him to the house and forbade my daughter or myself to come in contact with him. Having communicated this to the head master of the school as an excuse for his not returning to school, he replied that he wished for my medical man's name, as he, not unnaturally, wished for his own sake to know the facts of the case.

You would much oblige me if you would publish the three letters which have passed between these medical gentlemen, of course omitting names and addresses, as I should be glad to learn from the general opinion of the faculty whether under any circumstances a person could be pronounced safe from disseminating scarlet fever infection three weeks after first being attacked, and more especially when no desquamation of the cuticle had taken place before he was pronounced to be safe; and whether Mr. W——— had any justification for saying that the undoubted desquamation which took place six weeks after the boy "was first attacked" was not the result of the scarlatina for which he had been under treatment.

On January 29, 1881, the medical attendant of the college wrote the physician at the sea-side as follows:

Six weeks ago the pupil at ——— College, of the name of ———, showed symptoms of scarlatina. The usual precautions were taken by me as medical officer of the college, and in due time the boy was permitted to return home, after thorough disinfection. Having been informed that you have seen the lad within the last few days, and that you pronounce him still to be in an infectious state, I write to ask you if such is really stated by you, or whether, as I believe, there is not some misunderstanding.

On February 1, 1881, two days later, the medical attendant at the sea-side replied as follows:

On the 24th of January I was requested by Mr. ——— to call and see his son, who was said to be showing signs of desquamation. I had not seen him previously, and finding that such was undoubtedly the case, I recommended that he should be isolated, as well as kept in-doors during the cold weather, which has been prevalent.

The day following, the medical officer of the college replied to the sea-side physician's note as follows:

Thanks for your letter respecting young ———. I must be allowed to say, however, that when the lad left here, after three weeks' isolation (which began six weeks before you saw him), there were no signs whatever of desquamation of the cuticle. I must therefore give it as my opinion, that whatever may be visible now is not the result of scarlatina for which he was under treatment here. I repeat that there was an entire absence of "fever" in the case; indeed, so mild was it, that it was only owing to the great vigilance of our matron that it was brought under our notice. The boy never suffered in the least, and it was with much difficulty I could detect any eruption.

On February 21, 1881, the sea-side physician, the medical man who saw the peeling, replied with this note:

Will you allow me to state that the desquamation to which attention was called by the nurse of the patient, and for which my advice was sought, was confined to the palms of

the hands and the soles of the feet, in the latter case the cuticle coming off in somewhat large pieces. I saw nothing to justify the suspicion of eczema, and have no doubt whatever in my own mind that the scarlatinal poison was the cause.

This correspondence, lay and professional, only a part of which can here be given, indicates that in the opinion of the writers the termination of skin-peeling marks complete convalescence from scarlet fever, and its attainment should therefore discharge the patient from isolation and treatment. Though this sign is not uniformly present, it is a rule that has comparatively few exceptions, and it is therefore well enough to examine authority as to when desquamation takes place.

Trousseau says, "Desquamation in scarlet fever is not very well understood by the majority of physicians."

Hebra speaks of this process as terminating at the "end of the third week."

Dr. J. Lewis Smith speaks of desquamation as succeeding the disappearance of the eruption, and occupying "several days."

Mr. Malcolm Morris says it begins in the latter part of the second week, but may commence as the rash fades, or not until the end of the sixth week.

Prof. Flint says, "The duration of this stage is indefinite. It may end in five or six days. The desquamation is generally completed in from ten to twelve days, but, exceptionally, it continues for several weeks."

Dr. Bristow states that the period of peeling is variable in duration. "It is sometimes completed in one or two days, not infrequently extends over a week or two, and occasionally is prolonged for several weeks."

Dr. W. A. Rix, fever hospital, Bradford, England, says, "Out of nine hundred cases of scarlet fever, I do not remember to have seen one where desquamation at some period or other has not taken place."

I saw in April of this year a little girl ten years of age, living at 54 Chestnut street, La Fayette, who eight weeks before was seized with a mild attack of scarlet fever, so mild that her mother thought she had probably made too much haste in calling a physician to see her daughter. I made the child two visits, and told the mother I would not return again unless requested to do so. I had recommended that the yellow flag be kept out, and complete isolation maintained until peeling had taken place. Two or three weeks later I was called again, this time on account of the swollen condition of the child's feet, face, and hands. On examination, general dropsy was found to be due to albumenuria. Eight weeks after the seizure, desquamation was not completed in this case.

Scarlet fever patients are not desirable members of society until all traces of dead skin have disappeared, not only over the body, but from the palm surface of the hands and the soles of the feet, especially the heels. It so often occurs that this process is prolonged six, eight, and occasionally twelve or thirteen weeks, that authorities have recommended convalescents to be quarantined at least eight weeks. "In many cases,"

says Dr. Rix, "it has been extremely doubtful whether after nine weeks' quarantine the old, thick skin has been completely shed from all parts of the body and extremities. The great majority of our patients take from sixty to seventy days before we consider them fit to discharge from the hospital," and isolation should be maintained throughout; for the disease is infectious in some degree from the beginning of the attack to the termination of the peeling process.

No convalescent should mix with susceptible children until the stage of desquamation is complete, or until eight or ten weeks have elapsed from the seizure; and if convalescence has been interrupted, or some after effect of the disease remain, this interval should be longer. This is a hard rule, but parents, teachers, and physicians will find it safe and judicious. Sore throat in children, especially during the prevalence of scarlet fever, is a sufficient ground for keeping them away from school, and at home. "It is the slight cases of infectious sore throat, not bad enough to prevent children from going out-doors, or even to school or parties, that elude efforts to arrest epidemics of this kind in their usual course." The disease is infectious during the whole time of its existence, and the state boards of health have very properly declared it one of the diseases dangerous to public health, and prescribed measures for its arrest, and, so far as possible, its prevention.

From the foregoing, and much that is, from lack of time, obliged to remain unspoken, the following conclusions appear to be deducible:

1. That the duration of infectiousness of scarlet fever, especially in cases having mild beginnings, is often delayed, and, as a rule, the termination of desquamation marks the termination of infectiousness of the disease.

2. That, in a sanitary point of view, it is unwise to make any distinction between slight and severe attacks in the management of this disorder. Contact in either case will surely expose the susceptible to suffering and danger, if not death.

3. That in order to prevent the dissemination of infection, it is utterly wrong to permit any scarlatinal patient whatever to mingle with the healthy until the expiration of the stage of desquamation, which is generally about eight weeks from the beginning of the illness, and in those cases where the exfoliation is of late appearance, until this process is completed. In a few cases peeling is incomplete at the end of the tenth, eleventh, or even twelfth week, and is by no means always ended at the thirteenth week.

Authorities referred to: Prof. Bartholow—"Theory and Practice of Medicine;" David Page, M. D., in *The Lancet* (vol. 1, 1881); *The Lancet* (vol. 1, 1881); W. R. Rix, M. D., *The Lancet*, 1882; Quain's Dictionary of Medicine; Second Annual Report Indiana State Board of Health; Prof. Flint's Practice of Medicine.

XXXVIII.

PROTECTION AGAINST HYDROPHOBIA.

BY J. M. PARTRIDGE, A.M., M.D.,

MEMBER STATE BOARD OF HEALTH OF INDIANA.

The disease known as hydrophobia in man, and rabies in the animal, is as ancient as history itself. It is mentioned by Aristotle, Pliny, and Horace, but its virulent nature and alarming consequences seem not to have been well understood by the ancients, and Aristotle believed that man was not subject to its attacks; but it is now known to be peculiarly universal, and is perhaps the only disease which attacks alike man and the whole animal creation. Three hundred years ago the disease was very prevalent on the continent of Europe, but was comparatively rare in this country until the last century. Fifty years ago it was much more prevalent in this country than it is now. It has always been more prevalent in Europe than in America, probably on account of the greater density of population, and the consequent closer proximity of dogs to each other and to men. For the same reason, it has always been more prevalent in cities than in the country. There has been a greater mortality in France, in the vicinity of Paris, than in any other part of the world. Some countries seem entirely exempt from the malady. Hydrophobia is not known in South Africa, Egypt, Syria, Lisbon, and the South Sea islands, where dogs abound in swarming multitudes; and in Constantinople, where dogs roam at large, and subsist on offal of all kinds and descriptions, the disease is of very rare occurrence. In Jamaica it had not been known for at least forty years previous to 1783, when it was introduced by an infected dog from America. The island of Madeira is fairly overrun with curs of the most wretched condition and description, and they are affected with almost every disease, tormented by flies, by heat, by thirst, and by famine, and yet no rabid dog was ever seen there. In France the mortality from this disease is about one case annually in each 2,000,000 of inhabitants. In the department of the Seine, including the city of Paris, with an average population of about 1,000,000, for the forty years preceding 1870 there were ninety-four cases, being a little more than two and one third deaths per annum to 1,000,000 inhabitants. The death rate for the city of Paris is much greater. In the city of New York, with a population of about 1,000,000, for the six years preceding 1872 there were twenty-two deaths reported, or an average of three and one third per annum for 1,000,000 inhabitants.

Hydrophobia is communicated or induced by the bite of a rabid animal, usually the dog. The cat, fox, badger, wolf, and jackal are known

to have communicated the disease. The bite of a rabid animal does not by any means invariably induce the disease. The bite of some animals is more dangerous than that of others. Dr. Watson reported 114 cases bitten by rabid wolves, of whom sixty-seven, or more than one half, became inoculated and died, while of fifteen persons bitten by a mad dog only three, or one fifth, died. Dr. Hunter reported twenty-one cases bitten, and only one died. The experiments of Prof. Renault, of the veterinary school of Alfort, have demonstrated that not more than 33 per cent. of dogs bitten by rabid animals has become inoculated.

It is generally believed that only carnivorous animals communicate this disease; and of man, who stands midway between the carnivora and the herbivora, there is a difference of opinion as to his liability to communicate the same. I know of no case on record where hydrophobia has been communicated from man to man. Dr. Earl, of London, having been bitten by a rabid patient, immediately amputated the bitten finger. On being accused of rashness and needless fright, he inoculated several rabbits with the saliva of this patient, and some of them became rabid. Of two dogs inoculated with rabid virus from a man, one became rabid. Many experiments have been made to determine whether herbivorous animals can communicate the disease. In nearly all cases the effort signally failed. On this point, Prof. Youatt says,—"I can imagine that the disease shall not be readily communicated by the saliva of a graminivorous animal, but I have once produced it in a dog by the saliva of an ox, and twice with that of a horse, but in very many cases I have failed to do it." It appears, therefore, that the saliva of carnivorous animals is most infectious; that the saliva of man is less infectious; that the saliva of herbivorous animals is least infectious; but that it is possible for any rabid animal to communicate the disease.

The period of incubation, or the time intervening between the date of inoculation and that of the development of the disease, varies more than in any other contagion. The shortest period reported is seven days. In some well authenticated cases the period was several months, while in some more doubtful case a period of several years is said to have elapsed. The most authoritative statisticians say the period is from eighteen to fifty-nine days.

The terrible symptoms or manifestations of this disease, too frightful almost for contemplation, are too well known to need recounting here. Post mortem examinations have revealed but slight pathological changes or morbid processes,—chiefly some congestion of the brain and nerves, with slight destruction or degeneration of the nerve tissues.

The mortality in this disease is almost total, and it was generally believed to have resulted in certain death. The most favorable statistics report not more than two or three recoveries in one hundred cases; but the recent observations of Pasteur have thrown a flood of light on this subject, and given us a ray of hope for the future. In 1880 Pasteur began the investigation and study of hydrophobia. Having first transmitted the disease to a rabbit by inoculating it with the saliva of a child who

had died of this terrible disease at the Trossou hospital, he observed that the tissues and blood of this animal contained a special and peculiar microbe or bacteria, which was easily cultivated in a state of purity, and the successive cultures of which developed the disease, with fatal results, in other rabbits. The next important conclusion reached is, that the brain is essentially the seat of the disease ; and not only is the brain rabid, but also the entire spinal marrow ; and the nerves themselves throughout their entire length, from centre to periphery, abound in the rabid virus ; and, while the salivary glands are likewise rabid, it is due to the fact that the nerves which terminate there gradually empty the virus therein.

But the great practical result of these investigations consists in having determined the method of procuring a modified virus, which is harmless in the system, but which prevents the possibility of inoculation by the rabid virus. Pasteur believes he has attained this result, and he has submitted his theory to the French Academy of Science, and asked that a commission be appointed to test the same.

If we apply rationally the results I have just communicated, we can easily render dogs proof against rabies. The investigator may have, at his disposal, the virus of rabies in different degrees of attenuation, the non-fatal kinds preserving the economy from the effects of the more fatal kinds. Let us take an example : We take the virus of rabies from a rabbit which has died, after inoculation by trephining, at the end of a period of incubation exceeding by several days the shortest period of incubation commonly met with in the rabbit. This period invariably occurs between the seventh and eighth days after inoculation by trephining with poison of maximum virulence. The virus from a rabbit with the longest incubation period is inoculated again by trephining in a second rabbit ; the poison from this rabbit in a third. Each time the poison, which is becoming more and more virulent, is communicated to a dog. The dog is at length found capable of resisting a poison of fatal virulence. He becomes, in fact, entirely proof against rabies, when the poison of the mad dog of the streets is introduced into his system, either by intra-veinous inoculation, or by trephining.

The French minister of public instruction has accepted Pasteur's proposition, and has appointed a commission to test his theories and determine the accuracy of his conclusions. Scientific and medical men will await with great interest the report of this commission. If it is favorable, and if it should be shown that by inoculation with a non-malignant virus, hydrophobia can be intercepted and prevented in man, and rabies can be suppressed and stamped out in animals, then medical science will have achieved a brilliant victory.

A SANITARY SURVEY OF ST. LOUIS:

Being a Series of short Papers on leading Public Health Topics contributed by City Officials and Local Sanitarians.

EDITED BY GEO. HOMAN, M. D.

NOTE. Dr. J. P. Kingsley, Professor of Physiology and Diseases of Children in the Missouri Medical College, was unfortunately unable to complete the promised paper for the local series on "The Infant and School Populations, and existing Causes unfavorable to their Health," the absence of which from the collection is much to be regretted.—ED.

XXXIX.

THE SITUATION, SURROUNDINGS, AND SOIL OF ST. LOUIS, CONSIDERED FROM A HYGIENIC STAND-POINT.[1]

By GEORGE HOMAN, M. D.

Situated on the west bank of the Mississippi river, and partially embraced in a gentle curve of that stream as it bends toward the the east,—located in a territory whose confines are bordered by the Missouri river on the north and north-west, and remotely by the Meramec river on the south-west, while the area thus included is bisected by the river Des Pères, whose course lies for some distance within the municipal limits,—seated on a series of terraces that rise successively from the river front westward to a height of one hundred and sixty feet at a point about three miles distant from the water's edge, the city of St. Louis may be said to possess altogether commanding natural and primary advantages when viewed from a public health stand-point.

The ridges which form the benches or terraces mentioned, and which follow somewhat closely the general course of the river for some miles in the central front of the city, disappear about midway of the town in a narrow depression lying east and west, known as Mill Creek valley, which was and still is the drain-way for surface waters gathered in the outlying western middle parts of the city.

Near the north end of the town, where the heights are crowned by the two largest cemeteries in the city, a considerable tract of flat land of alluvial formation lies between the foot of the bluffs and the Mississippi, and through this bottom land several small streams find their way to that river. The principal ones, Harlem and Maline creeks, pierce the upland range respectively about four and a quarter and six miles north of the Mill Creek depression, and afford outlet for the surface waters of a considerable area lying in the north and north-western parts of the city and suburbs.

The water-shed of the rearmost portion of the city territory is toward and into the valley of the Des Pères, which stream skirts the western limits and forms the southern boundary of the city at its entrance into the Mississippi at South St. Louis. At this point the bluffs approach closely to the edge of the larger stream, and reach a height of about one hundred

[1] It was the original design to have this topic treated by Henry Flad, C. E., President of the Board of Public Improvements, but circumstances prevented the performance of the task by him as intended.—Ed.

feet. The original surface of the town site was rarely broken abruptly at any point, being usually gently undulating in character; and this remains a feature of the present suburban topography.

The capacity of the site and surroundings of St. Louis for perfect surface drainage may be said to be unsurpassed by any city of nearly equal size wherever situated, and this natural capacity and advantage have been skilfully supplemented and strengthened by artificial means.

The country adjacent to St. Louis on the west, presenting as it does a succession of swells and vales whose water-ways all tend southward, is largely devoted to market gardens and farms, while growths of hard-wood timber frequently appear on hillsides and along water-courses. The healthfulness of this region, reaching on the one hand to the Meramec river and on the other to the Missouri river, is undoubted, while the soil is fertile in cereals and fruits, and richly rewards efficient cultivation.

Opposite the front of the city, in Illinois, lies the well known American bottom, an alluvial plain some seven miles in its greatest breadth, and many miles long, now quite extensively cultivated; and while still subject in part to overflow during high water,—which usually occurs in the spring and early summer seasons,—has somewhat outlived its former notorious reputation for malarial unwholesomeness. But whatever ill effects the damps and miasms from this low ground exerted in earlier times upon the public health of St. Louis, they have long since ceased to be felt in the slightest degree.

There seems little reason to doubt that the river has at all times exercised a protective or screening influence upon the west bank in this respect; and the infrequency of local east winds has been a further advantage to the dwellers on this side of the stream.

There are no marshes or stagnant flats and shallows connected with the rivers near St. Louis, that are close enough to have any influence for evil on the health of her people. As before stated, her superficies as well as her surroundings are exceptional in this respect; while the character and quality of the soil upon which her foundations rest in no wise detract from her inherent hygienic integrity.

The blue-grass which appears here spontaneously and luxuriantly testifies to the good quality of the humus and mold which everywhere overlies a bed of usually dry, sound, compact yellow clay, which varies in thickness from ten to thirty feet. When incorporated with water, this substance is tough and sticky, making a brick of unusual excellence; but the contour and water-shed of city and suburbs are such that no plateaus or levels of any considerable extent appear where injury results from wetness of soil, or from standing water due to resistance to percolation of the underlying clay. Along the river front, and for some distance back, the clay formation rests upon limestone strata of varying thickness, while in the extreme western limits and in St. Louis county coal measures of good quality occur, beneath which are found extensive deposits of fire clay of great commercial value.

A peculiarity of the terrain of St. Louis and vicinity is the numerous

occurrence of circular basins or conical sink-holes ranging in size at the surface from ten to one hundred feet in diameter, and often twenty or thirty feet in depth. Their formation is explained on the supposition that in prehistoric times, when the surface of the land was submerged or was emerging from the flood, and while the clay deposit was still soft or plastic, these pits marked the sites of fissures in the underlying rock through which the waters drained away, the circular form being caused by the action of the water as it passed off through the opening beneath.

While much has been done by the people of St. Louis, through deliberation, inattention, or ignorance, to their own detriment and discomfort in a public-health sense, still such acquired drawbacks do not nearly outweigh the conspicuous advantages already briefly alluded to, and which may be summarized as follows:

1. The generally elevated character of the municipal site.

2. The present dryness and sanitary safety of the soil on which the city rests.

3. The almost perfect system of general drainage provided by both nature and art.

4. The instant removal and speedy destruction of the outpouring wastes and refuse thus collected, by the vast volume of the Mississippi, whose waters, turbid with suspended clay and sand, exert a purifying influence upon foul liquids mingled with them, independent of the effect of oxidation.

5. The soundness and safety, as regards freedom from organic admixture, of the public water-supply.

6. The salubrity of the surrounding country in respect of absence of swamps or marshes, with their accompanying malarial exhalations.

XL.

THE MEAN TEMPERATURE AND CLIMATIC CONDITIONS OF ST. LOUIS.

By F. E. NIPHER,

PROFESSOR OF PHYSICS, WASHINGTON UNIVERSITY.

The climate of St. Louis does not differ in any marked way from what might naturally be expected, when we consider its position in the interior of a great continent. We naturally expect greater and more sudden extremes than in the same latitudes near the ocean. The annual temperature of St. Louis is 55.4°, which is about two tenths of a degree above that of Washington, D. C., and about four tenths of a degree below that of San Francisco. The character of a climate is, however, best judged by a study of the law according to which it deviates from average or normal conditions.

It is necessary to determine the frequency of different degrees or amounts of divergence from average or normal conditions. This has not yet been fully accomplished for St. Louis, although, thanks to the zeal of our lately deceased friend, Dr. George Engelmann, the material for such discussion has been collected for a period of forty-eight years.

As regards the frequency of the highest temperatures, a few results suitable for presentation on an occasion like the present may be given. On the average, we have in St. Louis during the summer months,—June, July, and August,—twenty-three days when the daily maximum rises to or above 90°, between six and seven days when it rises to or above 95°, and one day when it rises to or above 100°. It may be a surprise to some to know that these same values are true for the city of Washington. During the last ten years we have had some of our warmest as well as some of our coolest summers. During the summer of 1881, the whole central Mississippi valley was oppressed with unusual drouth, and during the summer the temperature rose to or above 90° on forty-four days of the ninety-two; on twenty-five days the temperature rose to or above 100°, the highest temperature ever recorded in St. Louis—104°—being reached August 9th of that year. This, however, is a very unusual condition.

At present the records of Washington temperatures are not accessible to me for a period greater than seven years, but I find that in the summer of 1873 the temperature at that place rose to or above 90° on thirty-seven days; to above 95° on ten days, and to or above 100° on one day.

Since 1881, during three summers, we have had only thirty-seven days

during the whole three years when the temperature rose above 90°, and at no time has it reached 95°.

The effect of high temperatures upon people of feeble health depends in quite as important a manner upon the number of warm days as upon the excess of temperature above the normal, and for any continuous period of excessive heat the condition of producing a definite effect upon the human system is, that the duration of the heated period varies inversely as some power, possibly the first, of the excess of temperature above the normal.

Temperature, however, is not the only important element in determining the effect of hot weather upon health. Fully as important is the relative humidity, or degree of the saturation of the air with moisture. Of this our St. Louis weather has furnished us at least one most instructive case.

In 1878, from the tenth to the twenty-first of July, we passed through a heated term in which the daily maximum gradually rose from 93° on the tenth, to 97° on the sixteenth and seventeenth, falling as gradually to 92° on the twenty-first. At the same time the number of deaths from solar heat increased from two on the tenth to forty-one on the fifteenth, diminishing again to seven on the twentieth and zero on the twenty-first. The total number of deaths from solar heat during these ten days was 154.

In August, 1881, after an usually oppressive July, in which the average maximum was 92° and the highest 100°, a temperature of 95° or over being reached nine times during the month, we entered upon the hottest period ever observed in St. Louis. From the first to the sixth the daily maximum gradually rose from 92° to 97°, dropping to 89° on the seventh and eighth; it rose to 103.2° on the ninth, 99.4° on the tenth, 101.4° on the eleventh, 103.8° on the twelfth. The rest of the month was unusually warm. But during this period of eleven days the number of deaths from solar heat numbered three.

Several writers have referred to these two heated terms and the different effect upon the human system, and all have agreed that the case was full of mystery. As it appears that these writers were not well informed upon the subject of electricity, it was thought that this agent which they did not understand was the cause of the result which they could not otherwise explain—in much the same way that the scholiasts of the Middle Ages referred the authorship of all anonymous Greek manuscripts, out of which they could not extract any meaning, to Aristotle, by reason of his well known profundity.

But, in reality, the cause of the marked difference in the two cases is not difficult to find. In 1878, when the great mortality occurred, we had with the maximum temperatures of 97° an average daily relative humidity of 57 to 58 per cent. of saturation. The average daily humidity in 1881, with temperature of 100° to 103°, was from 38 to 40, and on one day 45, per cent. In 1878, during the greatest mortality, the relative humidity at 2 o'clock P. M. was 40 to 45 per cent. In 1881, during the

highest temperatures, the humidity at 2 o'clock was from 21 to 26 per cent. These low humidities were maintained, notwithstanding the hot July which had preceded, by reason of the fact that very little rain had fallen in Kansas, Missouri, Illinois, or Arkansas. The whole region was parched. The grass in the pastures crumbled under foot and burned like tinder. All of the small streams were dry, and most of the springs had ceased to flow. Forest trees began to wither and their leaves to fall. The only plants which seemed to be unaffected were the well known pests, the cockle burr *(xanthium strumarium)* and the Jamestown weed *(datura stramonium)*, which imparted its disagreeable flavor to the milk of cows, showing to what straits they were reduced for food. But it was this extraordinary dryness which made the extraordinary temperature endurable. And here the higher temperature of continental climates finds its compensation. The evaporation of moisture from the surface of the body goes on much more rapidly in air of low relative humidity and high temperature, and the latent heat of evaporation is continually removed from the body.

Citizens of St. Louis suffer quite as much discomfort in Philadelphia or New York, or even Boston, as at home. For my own part I suffered greater discomfort during the summer just passed in Philadelphia and Boston, with temperatures of 88° to 92°, than I did in 1881 on the prairies of Kansas and Missouri, exposed to the full blaze of the sun, with the thermometer reading from 105° to 107° in the shade.

The winter temperatures of St. Louis are, as a rule, not excessive. On the average we have about three days each winter when the temperature drops to or below —0°, and one day when it falls to or below —5°. The extreme minimum temperature observed in St. Louis is 23°, observed by Engelmann, January 5, 1884, and January 29, 1873. As a rule the winters of St. Louis are fairly well adapted to the production of the ice crop which seems to be necessary in the following summer, and lack the element of "rawness" which makes such a disagreeable feature of oceanic winters.

The precipitation of moisture is mainly in the form of rain. Snow is by no means uncommon, but it is usually light, and remains on the ground only a few hours, or at most a few days. The monthly rain-fall reaches a maximum of 5.48 inches in June, the greatest monthly rain-fall observed being seventeen inches in June, 1848.

The average winter precipitation is 7.64 inches of water, and the average summer precipitation is 13.7 inches. The average annual rain-fall is 42.5 inches, but during forty-eight years the annual rain-fall has varied from 21 to 69 inches. The greatest continuous rain-fall may be set down as 5 inches, which may be spread out over many hours, and has once been observed to fall in seventy-five minutes.

There is no element of the climate of St. Louis which differs essentially from that of other large inland cities similarly placed as to altitude and latitude, and here, to as great an extent as in any large city, the conditions of physical comfort are within the reach of the citizen.

XLI.

ORGANIZATION OF HEALTH DEPARTMENT, SANITARY LEGISLATION, AND THE ABATEMENT OF NUISANCES.

BY JOHN D. STEVENSON, ESQ.,
HEALTH COMMISSIONER.

In the organization of the health department of this city, the distinguishing feature is the concentration of the work of the department in an individual—the abandonment of the complex system by which all the work of the department was done, through the agency of boards, commissioners, etc.

The organization of the health department of this city, as it exists today, is the creature of the present city charter,—a charter anomalous in character, specially provided for by the present constitution of the state, and designed to free the city from the baneful effects of constant interference by the state legislature with the detail of municipal government. Under this charter and ordinance of the city the health department is created. It is managed, directed, and controlled by a board of health and a health commissioner.

The board of health consists of the mayor (who is its presiding officer), president of the council, one commissioner of police (designated by the mayor), two regular practising physicians appointed by the mayor, and the health commissioner, who, in the absence of the mayor, presides.

The duties of the board of health are judicial and supervisory.

The judicial powers of the board are exercised in determining what constitutes a nuisance detrimental to the public health, and on this question their action is final. They also hear and determine applications for admission of patients to the asylums for insane.

The supervisory powers of the board of health are exercised in the quasi control of the acts of the health commissioner. He can do no act in the administration of his office, unless the same be approved by the board of health.

The board or health examines all the expenditures of the department, and their approval is a condition precedent to the payment of all bills. The meetings of the board of health twice each week are fixed by charter and ordinance.

The health commissioner, by the charter and ordinances, is specially charged with a general supervision over the public health, to see that the regulations, laws, and ordinances of the city relating thereto are enforced and observed. Subject to the approval of the board of health, he is authorized and empowered to make such rules and regulations as will tend

to preserve and promote the health of the city, and to appoint such employés as may be necessary for the execution of his orders. In person, he can enter into, or authorize any of his employés or any police officer to enter into, and examine, in the day-time, buildings, lots, and places of every description in the city, to ascertain the condition thereof, so far as the public health may be affected by it.

The health commissioner declares and abates all nuisances condemned by the board of health. In case of proclamation by the mayor that any malignant, infectious, or contagious disease or epidemic is prevalent in the city, or will probably become so, the health commissioner, with the approval of the board of health, is invested with the most ample powers to avoid, suppress, or mitigate such disease, in the same manner and as effectually as the municipal assembly could itself do by ordinance. He can employ officers, agents, servants, and assistants, establish temporary hospitals, provide furniture, medical attendance, and nurses, as in the opinion of the health commissioner may be necessary and advisable: he can exhaust the entire appropriation for the health department, if necessary. These extraordinary powers, however, cease whenever proclamation by the mayor declares that the epidemic or disease inducing his first proclamation is no longer imminent or prevalent.

It is thus seen that the effective practical work of the health department of this city is in a very large degree imposed upon the health commissioner.

The operative machinery of the department consists of the board of health, health commissioner, city dispensary, with a complete outfit of ambulances, stretchers, etc., a sanitary corps, whose principal work is frequent house inspection. The institutions of the health department are the city hospital, female hospital, asylum for insane, poor-house, wherein 415 incurable insane are cared for, and a quarantine station, permanently established by ordinance.

The treatment of epidemics calls into frequent requisition this quarantine station. Small-pox and yellow fever have thus far created the necessities for its use, and fully justify the wisdom of its establishment. Yellow fever, in its visits in 1878–'79, by the prompt removal of all cases to quarantine, was completely extirpated. Small-pox, for like reason, has at no time become even localized, much less an epidemic.

This brief sketch of the health department involves sanitary legislation to the extent of the agents employed for its enforcement. The existent legislation itself embraces a multiplicity of objects, and is intended to reach all insanitary causes that experience has demonstrated to be peculiar to urban life. The special objects are dwellings, yards, outhouses, cellars, privies, surface drainage, sewer connections, garbage, offal, stables, cow-sheds, pig-pens, stys, slaughter-houses, dairies, meat shops, markets, distilleries; soap, candle, oil, glue, hemp, varnish, and white-lead factories; pork, sausage, and lard houses, and all other industries conducted by processes injurious to the public health; carts and

vehicles used to transport garbage, swill, and all other loose material; fouled bedding, clothing, putrid meat, fish, hides; stale, decayed, and unsound vegetables; wells and cisterns, ponds or pools of offensive water; tenement houses, boarding and lodging houses,—each and all are made subjects of especial official espionage, and when found in condition detrimental to public health, ample provisions are made to relieve the city of the causes of complaint. We may also class as sanitary legislation all ordinances providing for public and private sewers, removal of slops and garbage, removing and rendering of dead animals, cleaning streets and alleys, and especially regulating the construction of tenement, boarding, and lodging-houses. The abatement of nuisances involves the enforcement of the ordinances directed against the multifarious subjects of legislation to which I have referred. Under the code of the city the offences defined for the major part of the causes are directly reached in the police courts, upon complaint being declared misdemeanors; the remainder are subjects of special hearing before the board of health, and, if adjudged detrimental to public health, are abated by order of the health commissioner, or, by repeated fines imposed for failure to obey the order of abatement, the delinquents are finally driven to submit. The process of abatement of nuisances, as provided, is not effective, being too dilatory; the invocation of the courts to give effect to the action of the board of health affords to recusants too many opportunities to evade its requirements, and in many cases the delay incident to the proceeding utterly defeats the very purposes of the law itself, in denying a speedy remedy, which is the essence of the proceeding.

I have not attempted to present the detail working of the department, but have strictly confined this paper to the designated scope of the subjects indicated in the title. Yet it is not out of place to say that the health department of this city has met the requirements of its organization, and its work has been invaluable, as is fully attested by the mortuary statistics, which are the crucial tests of this class of work.

XLII.

SEWERAGE AND HOUSE DRAINAGE IN ST. LOUIS.

By ROB'T MOORE, C. E.

The sewerage system of St. Louis dates from the year 1849, which was also the year of "the great fire," and of the severest visitation of cholera in the history of the city. Prior to this time no sewers, in the modern sense, had ever been built in the city. A few stone or brick culverts had been built by private parties across the levee to drain property immediately adjacent thereto, but they were not intended for the reception of house drainage, and, as a rule, this use of them was expressly forbidden by a special proviso in the several ordinances which authorized their construction.[1] But now the building of sewers, as a sanitary measure for the removal of household and manufacturing wastes, as well as surface-water, was undertaken, and a system devised which was intended to embrace the whole city.

In taking this step St. Louis was preceded by very few cities, either in this country or in Europe. It is true that before this time sewers for the carriage of surface-water were in the older cities not uncommon. But in none of them, not even in London, was the building of sewers, prior to 1849, more than begun in any serious and systematic way as a sanitary measure. And it was common in England before this time, as it had been in St. Louis, to forbid the using of the sewers for the drainage of houses, or for the removal of anything but surface and storm-waters.

Nor was this step in St. Louis a sudden one, forced upon the people by the terrors of pestilence. The statute which empowered the city to proceed in the construction of sewers was passed during the winter preceding the epidemic of cholera, its approval being dated March 12th, 1849, and was the final result of a discussion which had been going on in the city council and in the newspapers for not less than eight years. This early discussion of the subject grew primarily out of one of the topographical features in which, as compared with other cities, St. Louis is peculiar, to wit, the presence of numerous "sink-holes" or basins, whose only drainage is through fissures in the underlying rock. These abounded in nearly every part of the city, and it was a favorite opinion with many that these natural underground outlets might be permanently relied upon to carry off not only surface-water, but sewage matter as well. One of these basins, whose centre was not far from the intersection of Ninth and Biddle streets, in what was then known as "the north-western

[1] See Ord. 626, June 19th, 1840. Ord. 679, Nov. 28th, 1840. Ord. 848, Nov. 17th, 1841. Ord. 965, May 4th, 1842. Ord. 993, June 6th, 1842. Ord. 1204, July 24th, 1843.

part of the city," was the source of much solicitude, as the area drained included many blocks, and the results of any stoppage of the outlets were sure to be very serious. During 1841 and 1842, several reports were made to the council by the city engineer, setting forth the importance of preserving these outlets; and several ordinances were passed appropriating money for the purpose of protecting them and keeping them open. In May, 1843, the city engineer, Mr. Henry Kayser, in a further report to the council, recommends the purchase by the city of the land (belonging then to Jonas Moore) upon which one of the largest of these sink-holes was located, there being, as he says, "the strongest probability that it will answer as a common sewer." The mayor, John M. Wimer, in a message to the council of the same date, also calls attention to this subject, but recommends, in opposition to the city engineer, that steps be taken towards the construction of a sewer as the only permanent and sufficient means of warding off the danger of overflow which was constantly impending. Nothing being done, the subject was again brought up, in May of the succeeding year, 1844, by the newly elected mayor, Bernard Pratte, who, in his first message, joins in the recommendation made last year by the city engineer to purchase the sink-holes, there being, he urges, "good reason to believe, from experience had thus far, that they can be used as drains or natural sewers, and serve as substitutes for artificial ones." The council referred the matter to a special committee, who, after careful examination on the ground, reported adversely to the recommendations of the mayor and city engineer, and urged the building of a sewer. Two months later an ordinance [1] was passed directing the construction of a sewer from the intersection of Seventh and Wash streets along Seventh street to Carr street, and thence under Carr street to the river, and authorizing an issue of $20,000, 7 per cent. bonds, to pay the cost thereof.

Nothing, however, was done under this ordinance, for the reason that the action proposed was beyond the powers then conferred upon the city by its charter, nor was the requisite power granted until five years later (March, 1849), as already related.

Meantime the condition of things grew steadily worse. The outlets of the sink-holes near Biddle and Tenth streets, which had been the subject of so much discussion, became stopped up, as nearly always happens in like cases, and a pond of stagnant water resulted, which was christened "Kayser's lake," after the name of the city engineer who had urged the preservation and use of these outlets as permanent sewers. The need of sewers for purposes of house drainage, and particularly for the drainage of wet cellars in all parts of the city, had also become very evident, and public sentiment was ripe for the comprehensive system of sewerage, which, as before stated, was finally begun in 1849.

The outlines of this system in its present form, which, however, is not essentially different from its original form, are as follows:

[1] Ordinance 1398, July 18th, 1844.

All sewers are distributed into three classes,—public sewers, district sewers, and private sewers. Public sewers are such as, in the words of the city charter, are "constructed along the principal courses of drainage." This class embraces all the main or trunk sewers, into which the laterals are discharged. As a rule, they are located in the valleys formerly occupied by streams, but in other cases they go through the ridges at considerable depth to drain sink-hole basins which formerly had no surface drainage. The first sewer constructed, begun in the summer of 1849, and intended for the drainage of "Kayser's lake," was of this latter kind. It is known as the Biddle Street sewer, and where it passes through the ridge, at Broadway and Biddle streets, was constructed as a tunnel at a depth of about forty feet. It is a circular brick sewer twelve feet in diameter, and was in its day counted as a great undertaking.

The largest public sewer is of the former kind, and follows the valley of Mill creek, a stream which took its name from an old mill that once stood on it, not far from Seventh and Poplar streets. West of the mill there stretched, for nearly a mile and a half, a long lake known as "Chouteau's pond," the site of which is now occupied by railroad depots and tracks. The sewer, which takes the water of the old stream, has a span of twenty feet and a clear height of fifteen feet, and is mainly built of stone. It drains an area of 6,400 acres, or ten square miles, and up to April, 1884, has cost the city $1,204,000.

All public sewers are paid for by the city at large out of the general revenue.

The second class, or district sewers, embraces such as drain limited areas or districts, the boundaries of which are, as occasion requires, fixed by ordinance. They are, in fact, the branch or lateral sewers, in contradistinction to the mains, which are included in the former class. Sewers of this class are built by the city, but are paid for by the owners of the property within the district, the cost of the sewerage of the whole district being assessed upon the several lots of ground therein in the same proportion that the area of the lot bears to the area of the whole district, after excluding all public streets and highways. The bills of assessment, which are by law made liens upon the property, are given to the contractor upon the completion of his work, and are collected by him without any recourse upon the city. Prior to 1859, the city paid the contractor in cash from the proceeds of bonds issued for each district, and collected the money from the property-owners by a special tax running through a series of years until the bonds were extinguished. But this method was found not to work well, and was abandoned for the one now in use, which is, on the whole, satisfactory.

The initiative in the construction of district sewers may be taken either by the property-holders, upon petition, or by the city authorities, who may by ordinance direct the building of sewers in any district, whenever in their judgment the public interest may so require.

After district sewers are built, they are maintained and repaired at the public cost, and are subject to the same regulation in all respects as public sewers.

The third class, that of private sewers, embraces all that are intended for the drainage of single houses or lots. These are built and paid for by the owners of the property drained, but are nevertheless by city ordinance made subject to certain general regulations, of which the following are the chief:

No private sewer can be connected with any public or district sewer, except in pursuance of a special permit therefor issued by the sewer commissioner, who has general charge of the sewerage of the city. If the private sewer is to be used for the drainage of an inhabited house, the sewer commissioner is required, before granting the permit, to satisfy himself, from an examination of the plan, a copy of which must be left with him, that provision is made, first, for preventing the passage of air into the house from the main sewer, or from any other house drain, and, second, for the ventilation of the drain within the house, by a constant circulation of fresh air. The first of these ends is accomplished by means of the ordinary disconnecting trap, which must resist the passage of air by an obstacle equal to at least one inch in depth of water. The second is attained by requiring that there shall be an air inlet between the trap and the house, and that the main soil pipe shall be continued above the house and left open.

The size of the drain and the materials used must also be approved by the sewer commissioner, and the work of making the junction with the main sewer must be done in the presence and to the satisfaction of an inspector detailed from the department for that purpose. But beyond these general provisions all the details of the work within the house are left to the discretion of the owner.

For private drains of any kind exceeding one hundred feet in length, the sewer commissioner can grant the permit only when the plan and profile of the proposed work have been approved by the board of public improvements, and upon the deposit with the city treasurer of money sufficient to pay the wages of an inspector appointed by the sewer commissioner to see that the work is properly done.

These regulations concerning private sewers are of comparatively recent date, the greater part of them having been drawn up by the writer whilst acting as the first sewer commissioner under the present city charter, and passed by the municipal assembly in 1877 and 1878. Before that time, it was the rule, here as elsewhere, to leave the private householder free to construct his house-drains in any manner he saw fit, provided only that he did not injure the main sewer by his manner of making the junction. As a consequence, these drains were very commonly constructed in gross violation of all the requirements of sanitary science. In particular, no attention whatever was paid to the ventilation of house-drains. The soil pipe was terminated at the highest fixture, and there was no provision for admitting any air, except that of the main sewer. In this, however, St. Louis was not behind other American cities, and the ordinance passed here providing for the ventilation of all house-drains built thereafter, and their disconnection from the air of the sewer, was, I

believe, the first one of the kind enacted in this country, though such ordinances since then have become very common.

Each of these three classes of sewers is designed and used to carry off the rain-fall, as well as the waste water from houses, and the whole, therefore, is an example of what is known as the "combined system." At first, indeed, the chief object of their construction was to get rid of storm-water, which, by collecting in ponds and cellars, had become a nuisance. With sewers already built for this purpose, the construction of another system, for the carriage of house-drainage only, as would be required to meet the views of the more strenuous advocates of the "separate system," has been found wholly unnecessary, and has not even so much as been thought of. Nor, so far as the writer knows, has this two-fold use of the sewers been productive of any evil results whatever.

The amount of rain-fall which the public and district sewers are designed to carry is one inch in depth per hour from the whole area drained, experience having shown that the sizes given by this condition are admirably suited to the local circumstances. House-drains are designed to carry off a still larger rain-fall, for the reason that the water which they receive gets into them much quicker than in the case of sewers draining larger areas. The usual rule is, to make them large enough to carry off two inches per hour from the whole surface of the lot drained. The size of pipe called for to satisfy this requirement is very seldom larger than six inches, though prior to the adoption of the present regulations it was not uncommon to lay a twelve or even a fifteen inch pipe for the drainage of a single house.

The grades of the sewers of all classes are as a rule quite steep. The minimum is one foot in one thousand, or one tenth of one per cent., which is the grade of part of the Mill Creek sewer. The grades of other sewers range from this up to eight or ten per cent., the latter figure being not uncommon for house-drains. The average in the district or lateral sewers is about one per cent., which is sufficient to secure a cleansing flow, and there is, I believe, no point in the city from which the sewage is not carried to its final outlet within an hour after its entry.

This final outlet is in all cases the Mississippi river, whose rapid current and enormous volume are sufficient to carry off and harmlessly absorb all that can be brought to it. In this great receiver, St. Louis is particularly fortunate, as it forever settles the question of sewage disposal, which in many other cities is one of very great and ever-increasing difficulty. It makes possible, and fully justifies here, a system of drainage which in other places and under other conditions might be impracticable and unwise.

In pursuance of the general plan thus outlined, work has gone forward with varying speed, until, up to April, 1884, there were built and in use $48\frac{1}{2}$ miles of public sewers, $174\frac{9}{10}$ miles of district sewers, and about $58\frac{4}{10}$ miles of private sewers, including house-drains, making a total of all classes of $281\frac{8}{10}$ miles. The area drained by district sewers is 4696 acres, or $7\frac{1}{3}$ square miles. This embraces a large portion of the closely

built parts of the city, including nearly all to which water pipe has been extended, as will more clearly appear from a map published with this, on which the districts supplied with sewers and with water pipe are indicated by coloring.

The cost of the system, exclusive of private sewers, whose cost is unknown, is as follows:

Public sewers, . . .	$2,942,827,	being	$60,816 per mile.
District " . . .	$2,932,588,	"	$16,758 " "
Total,	$5,875,415	"	$26,300 " "

The results obtained by this large expenditure have been highly satisfactory. Before the construction of sewers, much trouble was experienced throughout the city from standing water in cellars, even in the higher parts, where such a thing would hardly be expected. Cellars of this sort frequently and very naturally became receptacles for garbage, and even under the most favorable circumstances were offensive and dangerous. So great was the difficulty of keeping cellars free from water, that it was not uncommon for persons who had put them under their houses to fill them up again.[1]

As a natural result of this state of things the rate of mortality was very high. In the fourteen years from 1841 to 1854 inclusive, the average death-rate is given by Dr. George Engelmann, after a very careful study of the records, as $43\frac{6}{10}$ per 1000. Of these years, no less than five (viz., 1849, 1850, 1851, 1852, and 1854) were marked by the presence of cholera, which found here such a congenial home that it threatened to become a permanent resident. But even after eliminating the deaths from cholera, Dr. Engelmann finds the normal death-rate of that period to be no less than 34 per 1000.[2]

To-day a permanently wet cellar in St. Louis is a rare phenomenon. Within the area covered by sewers, the soil has been rendered thoroughly dry and clean. And taking the statistics of the last eight years, from 1876 to 1883 inclusive, we find the average death-rate to be now but $19\frac{8}{10}$ per 1000, or less than 60 per cent. of what it was before the construction of sewers, and as low as any large city in the world.

[1] The testimony on this subject in the newspapers of 1849 is very ample. Thus, on January 27th, 1849, the *St. Louis Republican*, conducted by Col. A. B. Chambers, states editorially that "There are few blocks in the city where there are not cellars containing more or less water. A large number are full, or nearly so, particularly east of Fourth street." In its issue for January 3d, the same paper has the following: "There are cellars in Pine, Olive, and Locust streets that have not been free from water for years past, and even now their condition is most offensive." On the same date Doctors Pope, McMartin, and McCabe, in a memorial to the board of health, say,—"Numerous cellars and basements, flooded as they are after every rain, are believed to be one of the most prominent sources of disease in St. Louis."

On February 28th, the *Republican*, in an editorial, has the following: "At present, the street gutters are the only sewers. These in warm weather become exceedingly offensive. In addition, in many parts of the city cellars cannot be kept dry. Day before yesterday we saw the owner of a block of buildings filling up finished basements because of the impossibility of draining them."

[2] See paper by Dr. George Engelmann in "Report on Diseases of Missouri and Iowa, by Thomas Reyburn." Philadelphia, 1855.

Of course this result is not due to any single cause. An improved water-supply, better housing, an increased knowledge of the laws of health, and more vigorous measures to abate nuisances and stamp out contagious diseases, have all contributed to lengthen life and lower the death-rate. But with all this, nothing is more certain than that these agencies would have been comparatively futile without the purification of dwellings and the drying of the soil, which the construction of sewers alone has made possible.


MAP OF PART
OF THE
CITY OF SAINT LOUIS,
SHOWING THE
Districts Supplied with Water-Pipe
and with Sewers.
Prepared for 12th Annual Meeting A. P. H. A., Oct. 1884.
Scale 2200 ft. per inch.
EXPLANATION.
shows Districts Sewered and Supplied with Water.
shows Districts Supplied with Water.
shows Districts Sewered.
Water-pipe in use April, 1884, 238 Miles
Public and District Sewers Completed April, 1884, 228 4/10
Private Sewers, about
MISSISSIPPI
RIVER
CARONDELET PARK
TOWER GROVE PARK
FOREST PARK
LAFAYETTE PARK
FAIR GROUND
ZOOLOGICAL GARDEN
O'FALLON PARK
BELLEFONTAINE CEMETERY
CALVARY CEMETERY
EAST CARONDELET
ARSENAL ISLAND
CAHOKIA
CITY OF EAST ST. LOUIS
TOWN OF BROOKLYN
VENICE
KERR'S ISLAND

XLIII.

THE PUBLIC WATER-SUPPLY OF ST. LOUIS.

By THOS. J. WHITMAN, C. E.,

WATER COMMISSIONER.

The first works to supply the citizens of St. Louis with river water, delivered through pipes, were commenced in 1829, and went into operation in the latter part of 1831. The enterprise was started by private individuals, but the works came into possession of the city about the time of their going into operation, or soon thereafter. Previous to this time the water used was obtained from wells, and though clear and palatable, it contained too much lime to be fit for manufacturing purposes, and was so subject to contamination from the drainage of a closely populated town as to make its use for domestic purposes undesirable.

The capacity of the works, as established in 1829–'31, was extended and improved from time to time until 1867–'68, when the water consumption of the city had reached about seven and a half to eight and a half millions of gallons per day. At this time (1867–'68) the pumping engines were located on the river bank at the foot of Bates street. This location was below, as regards the flow of the river, the drainage of over one third of the populated area of the city. The water was pumped to a reservoir located about a mile back from the river, on the high ground near 20th and Benton streets. This reservoir, when first built, had a capacity of about forty million gallons, but in 1867 had become so filled with sediment that practically it afforded no storage capacity, its use being little more than that of a stand-pipe, so that the water was delivered to the distribution pipes and thence to the consumers in just about the same condition as when taken from the river.

In 1868 the total length of pipes had reached about eighty-one miles, of which length fifteen miles was four inches and under in diameter. In 1865, surveys, reports, and plans were made, looking not only to the procurement of an increased supply, but also toward improving the character of the water to be furnished. These efforts culminated in the adoption of a general plan for new works, the construction being commenced (under the direction of the writer) in June, 1867.

The new system of works went into operation June, 1871, since which time the old works (except the pipes for distribution) have been wholly abandoned. The pumping station of the new works is at Bissell's Point, about two and three fourths miles above the Bates Street station. At the time of location, Bissell's Point was just at the northern limits of the city, though since then the city limits have been

extended some six miles above this point. The main and peculiar feature of the new works was the providing of a set of reservoirs called "settling basins," in which the water, before being delivered to consumers, was to remain long enough to allow the deposit of the greater part of materials carried by it in suspension when taken from the river. This arrangement required that the water be pumped twice, once from the river into the basins for settling (this pumping being called "low service"), and after settlement the clearer water to be pumped into the distribution pipes and storage reservoir (this second pumping being called the "high service").

The water is received from the river in an inlet tower placed in deep water about two hundred feet from the shore line. The water is conveyed through a sixty-six inch cast iron pipe to the low service engines, which are located on the river bank. These engines pump the water to the settling basins, four in number, holding about eighteen million gallons each, where it is allowed to stand from eight to eighteen hours, or as long as the present demand for water will admit. The quantity of sediment deposited in the settling basins, and removed each year, amounts to from one hundred and eighty to two hundred thousand cubic yards. From these basins the water is drawn off to the high service, and raised by the engines there through three lines of thirty-six inch pipes to the stand-pipe, whence it flows through two lines of thirty-six inch mains to the distribution pipes and storage reservoir. The stand-pipe is located on the high ground at the intersection of 20th street and Grand avenue. The limit of water line in stand-pipe is two hundred and eighty feet above the high service pumps. The storage reservoir is located at Compton hill, in the southern part of the city, and about five miles from the high service station. Its capacity is sixty million gallons, the high water line being at an elevation of one hundred and seventy-six feet above the city directrix.

At the present time (summer of 1884) the daily consumption of water is from thirty to thirty-three million gallons. The length of pipes is about two hundred and fifty miles, on which are placed twenty-two hundred and fifty fire-plugs, and thirty-five hundred and fifty stop-valves. The number of service taps is about thirty thousand five hundred. The population living within the water-piped area may be estimated at from three hundred and twenty to three hundred and forty thousand.

If the water, as taken from the river, could be left in the settling basins for from twenty to thirty hours, we should have a fairly clear water of most excellent quality. To have it entirely clear, some method of filtering or clarification would have to be resorted to. A sample of the water taken from the river, at the works, last August, contained 76.57 grains of matter in suspension per gallon. An analysis of a sample of water drawn from the service pipes, after passing through the reservoir (taken at about the same time), is reported upon by the chemist, Mr. F. H. Williams, as follows: "The sample was drawn from the supply-pipe of an establishment where water is constantly used in large quantities. As

the suspended matter in the water was in such a fine state as to require days for its sedimentation, it is practically as though it were in solution, and therefore no separation of the suspended matter was made. The residue left on evaporation of the water contained inorganic matter to the amount of 14.561 grains per gallon, as shown by the analysis.

Chloride of sodium	0.835	grains per gallon.
Sulphate of soda	2.452	" " "
Sulphate of potash	0.625	" " "
Sulphate of lime	1.633	" " "
Carbonate of lime	4.808	" " "
Carbonate of magnesia	2.209	" " "
Alumina and oxide of iron	0.547	" " "
Silica	1.452	" " "
Total	14.561	

Free ammonia	0.016 parts per million.
Albuminoid ammonia	0.088 parts per million.

The water was tested for nitrates, but they were not found to be present in appreciable quantities. Hardness (by Clark's soap test) was found to be eight degrees. In this connection it should be stated that the deposit of sediment in the storage reservoir is a little less than six inches thick. This reservoir has been in constant use since 1871—thirteen years. This would go to show that the settling basins do their work pretty well, though their capacity is much too small.

For some years it has been evident that the capacity of the entire works should be largely increased. During the summers of 1880–'81–'82 the consumption was quite equal to the pumping capacity, and the limit of the capacity of the present settling basins for thoroughly settling the water was reached some eight years ago. An extension of the works is now under construction. It is contemplated to enlarge them gradually to an ultimate capacity of ninety million gallons of settled and filtered water per day. It is proposed that the low service station shall be removed about six miles up the river, so as to be for all time to come beyond possible contamination by the city drainage. The high service station will remain in its present location, but will be so arranged that there will be two separate and distinct buildings, about three hundred feet apart, each supplied with pumping engines of a daily capacity of sixty-two million gallons. From the new house a separate system of pump mains will be laid to a second stand-pipe located about eight hundred feet from the present one. From the two stand-pipes the water will be carried to the distribution pipes and reservoir through lines of thirty-six and forty-eight inch pipes laid in different streets. It is not considered probable that any accident can ever occur that will disable both high service stations at the same time. This arrangement may therefore be considered as insuring as continuous a supply as if the water were obtained by gravity. The low service pumping, being under so light a head, can be maintained with certainty without requiring a duplication in this manner. When the extension of the works, as contemplated, is completed, the water-supply of the city of St. Louis will be equal to the best.

XLIV.

STREET AND ALLEY PAVING IN ST. LOUIS.

By JOHN W. TURNER, C. E.,
STREET COMMISSIONER.

The limestone foundation with which St. Louis is underlaid, cropping out as it did along the river front in bold bluffs, is a sufficient explanation of the fact that at first, and for a long time afterwards, limestone was the only material used here in the paving of the streets and alleys. It was first used in the form of rectangular blocks set on a bed of sand, the earliest example of this sort being a pavement laid on Main street in 1823. Nine years later, in 1832, an experiment was made with a layer of stone broken into small pieces, and afterwards consolidated by the traffic, after the plan which Macadam had, during the earlier part of the century, made popular in England, but which was in this country as yet somewhat of a novelty.

Until 1860 these two forms of pavement were the only ones in use, the limestone blocks being used for business streets and for alleys, where the latter were paved at all, whilst the limestone Macadam was adopted everywhere else. Since 1860, experiments have been made with almost every known material or form of paving, including wood, iron, bricks, porphyry, granite, asphalt in blocks, and asphalt in sheets; and specimens of each one of these, iron alone excepted, can now be found in the streets of St. Louis.

The principal materials in use may be seen from the following statement of the city pavements as they existed April 1, 1884;

	Miles.
Limestone Macadam	292.74
Granite and porphyry blocks	8.09
Wood blocks	6.40
Telford Macadam	4.70
Asphaltum sheet	2.58
Limestone blocks	1.45
Bricks and asphaltum blocks	.15
Total paved streets	316.11

To which should be added 66.09 miles of limestone block paving on alleys.

From this it appears that in point of mileage, limestone Macadam leads all the rest. This is due not to its intrinsic excellence, though it is infinitely better than nothing, but to the fact that for the great majority of streets, nothing better can be afforded. For, owing to the friable

nature of the stone here, the ordinary disadvantages of all Macadam pavements—mud in wet weather, and dust in dry weather—are found in St. Louis to an exaggerated degree. But whilst this is a source of much discomfort, and detracts greatly from the appearance of the city, the powdered limestone can hardly be called dirt in the sanitary sense, and, except as it may cause or exasperate diseases of the air passages, it is perhaps of no injury to the public health.

As a covering for alleys, the limestone block pavement, which is in almost universal use, has much merit. It allows the water to run off rapidly, and admits of perfect cleaning. Brick or sheet asphalt would, perhaps, be still better, but with these exceptions the alley pavements of St. Louis deserve to rank amongst the best. During the cholera epidemic of 1849, one of the chief difficulties in the way of the cleansing of the city, which was then undertaken, was found to be in the unpaved condition of the alleys. In fact, any thorough cleaning in such cases was impossible, and the committee of public health, who during the epidemic exercised a sort of dictatorship, mentioned alley pavements as one of the greatest needs of the city. The lesson taught then seems to have been well learned, and, except in the outskirts, unpaved alleys are now in St. Louis the rare exception.

The experience of St. Louis in wood paving has not been very encouraging. As a rule, pavements of this class have shown marks of widespread decay in four or five years, and in six or seven years have required entire renewal. They have, therefore, proved to be very expensive and unsatisfactory. A further experiment is now being made in the residence part of the city with blocks of gum-wood treated with chloride of zinc, and laid on a foundation of hydraulic cement concrete. But with this exception the wood pavements are all being relaid with granite blocks.

The purpose of the city authorities in the scheme of street reconstruction now in progress is to pave all streets of heavy traffic with granite blocks laid on concrete; to pave with asphaltum such streets of lighter traffic in the residence part of the city as will bear the expense of it, leaving the outlying streets to be paved with limestone Macadam laid upon a Telford base. If, when this scheme is carried out, a somewhat greater expenditure be made for street cleaning, and in summer for systematic sprinkling, the sanitary condition of the city, as regards its pavements, may be considered as fairly satisfactory.

XLV.

THE LOCAL MILK-SUPPLY—ITS SOURCES AND QUALITY.

By JOSEPH SPIEGELHALTER, M. D.,

MEMBER OF THE BOARD OF HEALTH, ST. LOUIS.

During the past few decades, the attention of sanitary authorities has been more than ever directed towards the detection and prevention of adulterations of different articles of food. A great deal has been done in late years in this direction, but a great deal more remains to be done. The most important part of the work has until recently been sadly neglected; that is, the sanitary control of the milk traffic.

If we consider that milk forms the principal food for children, and is most commonly used as a substitute for mothers' milk for infants, who, from whatever cause, cannot be nursed at their mothers' breasts, the importance of the good quality and purity of this article is apparent; and it strikes us at once that the great difference in the mortality among children under five years of age in cities, as compared with that in rural districts, must, to a great extent, be owing to the quality of the milk sold in cities.

Here is a large field for the sanitarian.

In Europe the governments have made ample provision for the protection of the public in this direction, and the sanitary and police authorities exercise a rigid control over the milk offered in the market. In the United States this duty is left to the state and local authorities, and in some of the states laws have been passed, which, if properly enforced, would put a stop to adulterations of milk and other articles of food. Here, in St. Louis, I am sorry to say, very little, or, rather, nothing, is being done in this direction at the present time. We have an ordinance forbidding the adulteration of food, milk, etc., forbidding the sale of watered milk, etc. (secs. 8 and 11, Art. XLV, Rev. Ord.), but this enactment is a dead letter so long as the city fathers in their wisdom refuse to furnish the health department with the means necessary to enforce the same. Nothing short of an epidemic will convince the average city father of the fact, that money spent for sanitary measures is money well invested; or, to use an old adage, that an ounce of prevention is worth a pound of cure. The cholera epidemic of 1866 and 1867, for instance, demonstrated to the city government the necessity for the extension of our sewer system after all previous arguments had failed to do so, and the same epidemic caused a reorganization of the health department, and liberal appropriations for the same.

Under such favorable circumstances, the board of health in 1871 could afford a city chemist, whose duty it was to look after the adulterators of food, the quality of the drinking-water, ice, etc. This liberal municipal spirit did not last long, however, and in 1875 the office of city chemist was abolished for want of funds. I will state briefly what was accomplished during the four years, from 1871–1875, in the way of improving the quality of milk sold in this city. From the first annual report of Dr. D. V. Dean, city chemist, dated June 1, 1872, it appears that nearly all the milk sold in 1871 was adulterated with water to the extent of 27 per cent. of its volume, not to speak of impurities, and the poor quality of the article derived from swill-fed cows.

During the year 1871, 1064 samples of milk were examined, of which 80 were milked in the presence of the messenger of the board, 22 were brought by persons who had purchased the same as pure milk, and the rest were taken from delivery wagons, stands, groceries, depots, etc. The following is a summary of extremes and averages of the quality of the milk as supplied to the city, and the same from dairies when milked in the presence of the messenger of the board:

	Average volume of cream—per cent.	Extreme volume of cream—per cent.	6 per cent. volume of cream and under—per cent.	8 per cent. volume of cream and over—per cent.	Extremes of solids—per cent.	Average solids—per cent.	Extremes of water—per cent.	Average of water—per cent.
Delivery	5.51	.5 to 20	74.6	15.66	5 to 16.5	10.3	95 to 83.5	89.7
Dairies	11.15	7 to 25	10 per cent. volume cream over 76.31	12 per cent. volume cream over 26.31	12.78 to 15	13.6	87.22 to 85	86.4

The extremes in the volume of cream in milk taken from the stands, groceries, etc., were greater than those in milk taken from delivery wagons. This is owing to the greater facilities for adding water at the stands, and to the fact of water being added sometimes without knowledge of the degree of previous dilution. Besides this, the milk is not shaken as in the wagons, and the cream rises and may be removed, or the milk and cream may be unevenly dispensed, bottom or thin milk being supplied to one customer, and surface or rich milk to another. The adulteration in most cases was simply water: some samples were found which contained boiled ship-stuff, and others to which infusions of screenings, oats, and bran had been added. A considerable quantity of dirt, and of living decomposing matter, is added to milk from water from roofs, standing casks, poor wells or cisterns. One sample of two ounces of milk, purchased as "baby-milk," poured into a precipitating glass,

showed a deposit of nearly a cubic inch of silt, particles of the hulls of grain, etc. Such substances were found in great abundance in winter milk supplied to St. Louis by some of the country dairies, but to no such extent as in that supplied by the swill dairies of the city. Using conical test tubes, a sediment composed of hairs and fragments of bran, particles and structures from the different cereals, rust spores, the pap of distillery wash, silt, etc., are found in so considerable proportions that it is difficult to resist the supposition that it comes from added infusions, or decoctions of different grains and bran; but the vegetable structures are largely broken up into their elements, and the greater part of the starch granules do not show the normal reaction with iodine, but act like the starch which has passed through the alimentary canal of an animal. Cows were repeatedly milked in their stalls in the presence of the messenger, and the examination of the milk always gave the same result. In one of these samples of a few ounces a single microscopic preparation from the sediment contained three meal mites (acarus farinæ, an acarus found in injured flour), with several ova of the same species. The presence of these in the milk is suggestive of the wretched surroundings which furnish them.

From an area of three or four square feet of mould on a loose board partition, separating the living room of the family from the cow-stable, the chemist, Dr. Dean, stripped a small patch, which contained bran, meal, ship-stuff, and the like, and occasional "acari." The proprietor of the dairy informed him that every drop of his cows' milk was strained five or six times before it was sent to market—a statement implying a very disagreeable necessity. When, as in such instances, all sanitary laws are disregarded in the feeding and general care of the cows, when swill forms the principal food for the cows, when the stables are reeking with filth, the milk cannot possibly be good and healthy, and it is not at all surprising that babes cannot thrive upon it. But not only is the health of consumers affected by impure and adulterated milk, their purses suffer likewise by the nefarious practice of watering the milk, as will appear from the following tables taken from the city chemist's report of 1872. The number of cows in the city at that time, according to the census taken by the police and the messengers of the board of health, was 7,000
and the number from outside the city was 1,800

making a total number of cows supplying the city with milk . . 8,800
but taking a round number, it may be said that the total number of cows supplying milk for the city was 9,000

The number of gallons of milk and cream supplied per day, if cows average one and one half gallons all the year round, would be 13,500 gallons; five per cent. of this is removed as cream, leaving the number of gallons of milk furnished by cows per day . . 12,825

The number of gallons daily consumed in the city, at the rate of one quart for five persons, the population being estimated at 350,000, is 17,500

The number of gallons of milk consumed each day in excess of what is furnished by cows, *i. e.*, added water, is 27.6 per cent., or 4,675
Cost to the inhabitants per year for water added to and sold for milk at the rate of 27 cents per gallon, $400,721.25.

From these figures it appears that the population of this city has been robbed of nearly half a million dollars a year by men who sold water for milk at the rate of twenty-seven cents per gallon.

This is more than one hundred times the amount for which a chemist and a few dairy inspectors could be engaged; and yet the office of city chemist and microscopist was abolished in 1875 for alleged reasons of economy, and has not since been reëstablished.

In order to still further illustrate this perverse policy of economy, I shall give the comparative table showing the amount of water added, and the volume of cream contained in the milk found during the years 1871–1874, according to the chemist's report of 1872, '74, '75:

	Number of samples examined each year.	Average volume of cream per cent.	6 per cent. volume of cream and under.	8 per cent. volume of cream and over.	Added water per cent.
1872	1064	5.51	74.6	15.66	27.6
1874	848	6.66	53.0	36.46	1.4
1875	629	8.25	42.7	47.37	3.2

This table shows very plainly the effect of the labors of the city chemist in the prosecution of the adulterators of milk. During the years 1874 and 1875, the water added to the milk was but 3.2 per cent., while the volume of cream increased from 5.51 to 8.25 per cent. The consumers, therefore, bought 24.4 per cent. less water, and received 2.74 per cent. more cream in their milk than previously. With milk at 27 cents, and cream at $1.20 a gallon, and a quart of milk to every five persons per day, the yearly saving of 400,000 people in water alone amounts to $413,040, and the gain in cream belonging to that quantity of milk, $240,034, making a total annual saving of $653,074. Exactly how much we have paid for water during the last nine years, since the office of city chemist was abolished, I am unable to state; but, taking the calculations of Dr. Dean to be approximately correct, I may safely say that the amount of money which the people have paid for water, and lost in cream due to them, during these nine years, would be sufficient to build the much needed new hospital and addition to the asylum for insane, and still leave enough for the erection of a respectable city hall.

The sanitary condition of the dairies has been materially improved

during the past nine years. By the energetic action of the board of health, the worst of the city dairies, especially those where swill was almost exclusively fed, have been exterminated; others have been driven outside of the city limits, where the cows can at least have the benefit of fresh air, and perhaps some pasturage.

From a census of the dairies inside the city limits, which was recently taken by the health department, Dr. W. Hall, chief sanitary officer, has compiled the following table showing the number and sanitary condition of the dairies and cows within the city:

Total number of cows in the city		5868		
Of this number there were in good condition . . .		5179	or	88.2%
" " " " " " fair " . . .		92	"	1.6%
" " " " " " filthy " . . .		597	"	10.1%
The total number of dairies was found to be		240.		
Of these there were in good condition		178	or	74.1%
" " " " " bad "		18	"	7.5%
" " " " " fair "		5	"	2.1%
" " " " " filthy "		39	"	16.2%
The ventilation was found to be good in	89 dairies, or			37.1%
but was found to be not good in	32 " "			13.0%
Condition of ventilation not ascertained in	119 " "			49.6%
Dairies having good drainage were	104 "			43.3%
" " defective " "	41 "			17.1%
" " poor " "	7 "			2.9%
Condition of drainage not stated in	88 " "			36.6%
With regard to food, Dr. Hall states the number of cows fed on ordinary food, including malt, bran, and hay mixed with swill, to be		3395	or	57.9%
Same food without swill		925	"	15.9%
Fed on good mixed feed with swill		1025	"	17.4%
Fed on good mixed feed without swill		410	"	6.9%
Kind of food not stated		114	"	1.9%

This report shows that the dairies need frequent inspection to keep them up to the ordinary sanitary requirements, and that swill is still fed in considerable quantity, although it is in no instance used as principal food, as was done in former years.

But this report also shows that the main source of supply of milk has been changed. While the population, and consequently the demand for milk, has steadily increased, the number of milch cows in the city limits has decreased from 7,000 in 1871 to 5,868 in 1884. It is safe to state that more than one half of the milk consumed in the city now comes from the country, and is distributed by the different dairy companies here. These dairy companies, getting their supply from the country, are, of course, not willing to pay freight for water, a commodity which can

be had here at a nominal price, and of better quality than the average dairy farm furnishes.

It is therefore to be presumed that they receive their milk unadulterated with water, and stretch it only when the demand exceeds the supply. I have not been able to ascertain the daily quantity of milk shipped to these companies, and can only speak of one, which, however, is a model in its way. I mean the St. Louis (or Cabanne) Dairy Co., which distributes daily about 900 gallons of milk and about 125 gallons of cream. They have a laboratory in connection with their milk depot, and examine and analyze their supply of milk regularly; they also exercise a strict control over their delivery wagons.

A similar system of examination and control of the milk, inaugurated by the city authorities, would save the citizens hundreds of thousands of dollars a year, not to speak of the beneficial influence it would have in lowering the death-rate of children. It is astonishing how indifferent many people are to the quality of milk they buy. Men who otherwise are very particular as to what they buy, and who want to get their money's worth in every other purchase, consider the addition of water to milk a harmless fraud or adulteration. It may be worth while to illustrate the harmlessness of this adulteration:

The water-supply of the dairies is generally derived from a cistern or well on the premises, and is more or less contaminated by the seepings from the cow-stable or manure pile. But supposing they get their water from some well in the city, they are not much better off. Fully two thirds of the 9,000 or 10,000 wells in the city are contaminated with sewage. Besides other impurities, the water generally contains micro-organisms of different kinds, and in times of an epidemic especially is full of disease germs. It is almost impossible to obtain pure water in the city, except by filtering, or boiling, or both. Even the hydrant water is far from being pure, and at times contains a considerable quantity of vegetable matter. Taking into consideration now the fact that milk is known to be the best propagating and breeding menstruum for all kinds of micro-organisms, we can well imagine how the seemingly harmless addition of water to milk may, under certain circumstances, transform the same into a first-class poison, spreading disease and death to the unsuspecting victims. These facts here set forth ought to be sufficient to explain the absolute necessity of a rigid and efficient control of the milk-supply; but I will give some figures which will demonstrate the necessity from another side. In order to be able to say something about the quality of the milk at the present time, I requested Dr. Heckelman to analyze a few samples of milk procured from different dairies and milk depots in the city.

The result is as follows: Of the four samples examined, all of them were skimmed; the volume of cream contained in the milk ranged from 4 to 10 per cent. instead of 15 per cent. Two of the samples were watered to the extent of 10 or 12 per cent.

Taking the average volume of cream of the four samples to be 7 per

cent., the consumers were robbed of 8 per cent. of cream to which they were entitled. Assuming the average quantity of milk consumed to be one quart a day for every five persons, and the population 400,000, the amount of milk consumed would be 80,000 quarts, or 20,000 gallons; 15 per cent. of this should be cream, but only 7 per cent. is furnished with the milk sold for unskimmed milk. The missing 8 per cent. of cream for 20,000 gallons amounts to 1,600 gallons per day, which, at $1.20 a gallon, is worth $1,920 a day, or $700,800 a year. Even if we wished to be modest, and be satisfied with only 12 per cent. volume of cream in our milk, we are still 5 per cent. short of what is due us, and this 5 per cent. of missing cream represents a value of $438,000 a year.

Calculating an addition of only 10 per cent. of water sold with the 20,000 gallons of milk every day, we have 2,000 gallons of water sold for milk at a cost of twenty-eight cents per gallon, and amounting to $560 a day, or $204,400 a year. If all appeals for the protection of the poor innocent children are of no avail, these figures should be sufficient to convince any one that it is very poor economy to lose $900,000 in order to save the paltry sum of $4,000 or $5,000, which the sanitary control of the milk supply of the city would cost.

XLVI.

THE LEADING LOCAL PRODUCTIVE INDUSTRIES, AND THEIR EFFECT ON THE HEALTH AND LIVES OF THEIR OPERATIVES.

BY GEO. HOMAN, M. D.

I am unable at present to offer more than a preliminary statement on the subject assumed by me in the local series of papers, as, from its nature, a somewhat extended period of observation of the effects of a given employment on those engaged in it is necessary in order to enable the observer to deduce just and accurate conclusions therefrom.

When the idea of a survey of the existing hygienic situation in this city was first suggested, it was thought to be an important part of the scheme that inquiry should be made into the condition and environments of operatives in our leading lines of manufacture; and in pursuance of this idea, a circular was prepared, and addressed to the proprietors and managements of establishments devoted to brewing, tobacco manufacturing, ore smelting and metal working, jute and cotton manufacturing, and the making of drain pipe, fire brick, etc., these enumerated industries being among those here which employ the largest number of operatives, especially young people of both sexes between 12 and 21 years of age.

While the responses received in answer to the circular thus sent out were encouraging, it was believed, after due reflection, that the attempt to include all the lines of business named would result in but partial success, and the collection of imperfect and insufficient data; and it was therefore decided to restrict the inquiry for the present to the single line of tobacco manufacture—an industry that has had such a remarkable development here within the past few years as to place the St. Louis district very nearly, if not entirely, in the lead in this country as regards magnitude of output of the manufactured product.

The factories here number some half dozen establishments, each employing from 200 to 1,000 hands—the number employed depending on, and varying somewhat with, the season. In the plug, smoking, and fine cut tobacco factories, a large proportion of the hands are boys and girls above 12 years of age, who strip the leaf from the stem, and whose wages are based on the amount of work they perform.

These establishments, with one or two exceptions, are new and large, and were planned and built with a very considerable degree of reference to the needs and comforts of the employés.

The blank forms for use in the prosecution of this inquiry were prepared after consultation with gentlemen engaged in the tobacco

business, and space in them is allowed for careful classification as to age, sex, nativity, color, social relations, domicile with parents or other relatives, length of time employed, and locality of residence—this information to be furnished by the managements of the factories in which the inquiry is prosecuted.

The points to be noted by medical and hygienic inquiry and observation as regards the personnel of the establishments, and surroundings of employés during hours of labor, are as follows :—

1. Hours of labor and how paid. By the day, or by the piece?
2. Character and situation of buildings and rooms where employés work.
   a. Average space allowed each employé.
   b. Means provided for ventilation, lighting, heating, etc., in all seasons.
   c. Conveniences afforded employés, as elevators or stairways, drinking-water, dressing-rooms, water-closets, etc.
   d. Care bestowed on interiors (walls, floors, etc.), as painting, whitewashing, scrubbing, and sweeping.
   e. Amount of dust or other floating matter in the air.
3. Effects of employment observed in those working in tobacco.
   a. General physical appearance of operatives of all classes. Differences, if any, observable between recent and old employés.
   b. How affected when first commencing the work.
   c. Peculiarities, if any, observable in those engaged in different departments or special branches of work.
   d. General and special effects, if any, due to a given occupation on the nervous, muscular, digestive, and absorbent systems, and organs of circulation, respiration, sight and hearing of all classes of employés.
   e. Approximate loss of time from illness traceable to occupation.
   f. Monthly or quarterly fluctuations in number of employés from all causes.
   g. Auxiliary substances used in the manufacture of tobacco, and special processes employed.
   h. Variety of manufactured products, and degree of special skill required in operatives.

Such being an outline of the work in view, it it hoped that close observation and study of the facts, and information which it is hoped will be thus collected, will enable me at some future time to offer results and conclusions on the effects of tobacco handling and working on immature and growing, as well as adult, operatives, that are safely based, and which will have a permanent value to the student of industrial hygiene.

No. of Ward.	No. of Inhabitants per Acre.	Death Rates per 1000 Inhabitants.
1	71	19
2	65	17
3	63	20
4	84	23
5	74	24
6	34	22
7	54	23
8	12	26
9	25	21
10	90	21
11	9	20
12	81	24
13	30	25
14	54	23
15	33	22
16	18	23
17	57	22
18	34	18
19	9	21
20	24	20
21	4	26
22	3	22
23	1	24
24	11	19
25	0.2	20
26	1	21
27	1	15
28	2	21

XLVII.

THE CHIEF LOCAL FACTORS IN THE CAUSATION OF DISEASE AND DEATH.

By ROBERT LUEDEKING, M. D.,

PROFESSOR OF PATHOLOGICAL ANATOMY IN THE ST. LOUIS MEDICAL COLLEGE, AND LATE CLERK ST. LOUIS BOARD OF HEALTH.

One of the most striking peculiarities of the city of St. Louis is the large area over which its population is distributed, so that, according to the census of 1880, the number of persons to the acre was but 8.7, the entire area being nearly 40,000 acres, and the total population being 350,522; and taking the area of the old city limits, we had then a density of but 26.39 to the acre, there being 326,940 residents within an area of 12,386.4 acres. In the year 1883 the density was computed at 9.8 persons to the acre, the greatest density being 90 persons to the acre in the tenth ward, and 0.2 persons to the acre in the twenty-fifth ward.

This is indeed a low density compared with that of most metropolitan cities: that of London, for instance, is given at 52.5 to the acre in 1883. And yet we find the annual rate of mortality per thousand in London in 1883 to have been but 20.4, while that of St. Louis was 21.35. With such a variance existing in the relative densities, and a rate of death in favor of the city of greater density, it must needs force itself upon our conviction that inherent faults in our sanitation must be the cause. On scrutinizing the table of the distribution of our mortality in 1883 by wards (see appended map), we find that the lowest rate of 17 per thousand is found in the second ward, with a density of 65 persons to the acre, and that the highest mortality prevails in the twenty-first ward, being 26 per thousand, with a density of four persons to the acre.

In this twenty-first ward having the highest mortality, we have an area of 1,012 acres; and reference to the sewer and water-pipe map shows that not more than half a dozen blocks are sewered and supplied with water, while, on the other hand, the second ward, 233.8 acres, is perfectly drained and supplied with water; and yet this ward, together with the fourth, tenth, twelfth, and fourteenth wards, contains the greatest number of tenement houses and habitations of the poor. Each and every block of the territory mentioned, however, is supplied with an abundance of water from the municipal water-works, and nearly every house is connected with a district, private, or public sewer. The result is most striking in that the rate of mortality does not exceed the average, in fact is but 21.2, while the density is 75 to the acre. This

very striking contrast demonstrates beyond question the utility of a perfect drainage and water-supply in lowering the mortality of large cities.

An examination of the tables of mortality of the City Health Department, and comparison with the water and sewer map, will show the sanitary disadvantages of the thinly populated districts without sewerage and water-supply, as against the densely populated districts that are well provided for in this regard. Low, marshy ground along the river bank, and some of the western districts that abound in ponds and sink-holes, have high mortalities, and are fit subjects for earnest consideration by the sanitary engineer. The fuller consideration of situation, soil, surroundings, etc., of St. Louis, has however been had in detail in papers preceding this one, and there is a disposition, especially at the present time, to extend our public water-supply, our sewer system, and to improve the quality of our street paving. Undoubtedly our prevailing climatic conditions, showing rapid changes from extremes of heat and cold, have a telling effect upon our mortality and death statistics.

Inasmuch as this paper is to be embodied in the transactions of this association, together with the results of the investigations of my predecessors on more pertinent subjects, it remains for me only to state that a most potent factor in the causation of sickness and death is to be found in the slight efforts put forth by the city of St. Louis in the direction of preventive measures.

The health commissioner, only in the past summer, with cholera prevalent in southern Europe, was by the municipal assembly refused the paltry sum of $15,000 to defray the expenses of a complete house to house investigation of the city. Yet a work of this character has never been done in our city, and once done might have made the basis of preventive operative measures for years to come. A complete sanitary survey of the city could have been so accomplished. As it is, our health department to-day presents the anomaly of being without a corps of sanitary inspectors.

And in many other regards St. Louis has reason to be ashamed of its neglect of precautions and safeguards that every civilized community should observe. Notwithstanding that our milk-supply is notoriously bad, and that adulterations of food are common, there is no provision whatsoever in our charter or ordinances for a chemist, or for a corps of inspectors of milk or meat and other provisions. Our public markets should be specifically regulated by ordinance, and a systematic supervision by a competent officer is imperative.

Another most glaring defect in our legislation is the absence of a law governing plumbing, and providing for competent inspection of our house drainage. In the Eastern cities private corporations undertake to make intelligent and competent inspection, at given intervals, of the plumbing, drainage, heating apparatus, and ventilation of private dwellings for moderate compensation. We in St. Louis do not, so far, enjoy the satisfaction of such a necessary luxury.

Further sanitary measures of a preventive nature, that are poorly pro-

vided for, is our system of street and alley cleaning. Only a pittance is allowed for this most important work. The failure to provide amply no doubt costs many a life. Our method of removal of refuse and garbage, and the removal and disposition of dead animals, should be extended, improved, in fact, entirely changed.

All of these points are intended to convey the fact that in point of public sanitation much must be done in St. Louis.

Our control of cow and other stables, of rendering establishments, and other offensive trades, is insufficient. In fact, the whole *modus operandi* for the abatement of nuisances, even the simple and every-day kind, is too cumbrous and clumsy. If an offender be refractory, it takes a month to remove a *bona fide* abominable nuisance.

The management of contagious diseases is pretty well provided for. At any rate, notification of all cases is demanded; and exclusion of all children, that may convey contagion, from the public schools is practised.

In summing up, I desire, therefore, to state emphatically that the chief factor in the causation of disease and death in St. Louis is the disregard of nearly all those measures that have been so ably and eloquently advocated this week by the members of this association. It is to be hoped that the citizens of St. Louis will become aroused to the incalculable benefits to be derived from the ounce of prevention. No representatives should be chosen to the municipal assembly but such as have learned that all things municipal should be made subservient to that greatest factor in the promotion of welfare, the *public health.*

XLVIII.

THE MANUFACTURE OF SODA-WATER FROM POLLUTED WELL-WATER.

By FRANK R. FRY, A. M., M. D.,

St. Louis.

Several physicians who have their offices in the immediate vicinity of the largest manufactory of soda-water in this city, have for some time known that a large quantity of well-water found its way into the products of this establishment. It was also suspected that the same was true of other establishments in the city.

Knowing the difficulties our local board of health has to contend with in such cases, and thinking to create a wholesome sensation, some data were furnished one of our daily papers, to which they industriously added other facts, and from them printed an article that attracted considerable attention, especially as it appeared during the time last summer when there was most talk and some concern felt about the approach of cholera. The article was valuable, as it developed the fact that all the manufacturers of soda-water in this city excepting one, on their own admission, used well-water in making their products,—in all instances the water being taken from wells in populous portions of the city.

Here I wish to digress long enough to state a few facts about the wells of St. Louis that will help to show the importance of the subject at hand. The number of wells here is not known, but Mr. W. Kennett, of the city sanitary office, states that several years ago, when the police force was ordered to report all the wells throughout the city, over seven thousand were enumerated, and the returns were still not complete. But, with this report as a basis, it is estimated that there are between nine and twelve thousand wells in the city.

Between the dates of July 9th and September 30th, 1884, Dr. John A. Heckelmann, the chemist employed by the city board of health, examined the water of forty of these wells, they being wells that were reported as suspicious, with the following results: "Nine of them contained good water, three usable water, two dangerous, twenty-six unfit for drinking purposes." These results were obtained with a rather variable criterion of good and bad. In determining to which class a well belongs, all of the following points are considered: Color, odor, taste, and transparency of the water, the microscopical examination, the chemical examination, including an estimate of its hardness, the total solids, metals, chlorine, organic matter, sewage, free ammonia,

nitrates and nitrites. Also the location of the well, its proximity to vaults, sewers, etc., the amount of water constantly taken from it, and its depth. But so far as I can discover there is not a fixed limit or definite figure determined in regard to any one of these points, a conclusion being reached from the general showing of the water from each well that is examined.

The gentleman above referred to has expressed an opinion that all the wells in an area extending from Cass avenue on the north to Chouteau avenue on the south, and from the river back to 14th street, are more or less contaminated by sewage. This statement is not meant to imply that some other districts are not just as bad, but it covers the ground in which we are now most interested.

It is not necessary to give details to reveal the importance of this matter, but its enormity (from a sanitary standpoint) will appear by reciting the circumstances of one instance. The establishment where the largest amount of fountain soda is manufactured (probably two thirds or three fourths of all used) in the city is located on 8th and St. Charles streets, in the heart of the city, in a thickly settled block covered with old buildings, destitute of many modern improvements. There are sewers on three sides of the block, and a private one in the alley immediately alongside the establishment. During a large portion of the year this alley is in a filthy condition. The water used is drawn from a well, under the building, thirty-five feet deep. The proprietor freely admitted that he used this water in the manufacture of soda-water, and only regretted that he had not more of it, as the supply was not sufficient, and he was compelled to mix with it more or less of other water. It is a peculiarly significant fact that this very block was described as a cholera centre thirty years ago, and the fact was accounted for by the probable condition of the water in the vicinity.

It is interesting to read in this connection a portion of the report made in 1855 to the American Medical Association by Thomas Reyburn, M. D., "Chairman of the Committee on the Epidemics of Missouri, Iowa, etc." On page 152 of this report he says,—"Among the localities within the city that may be noted as cholera districts, are the first and second wards in the southern section, the 'graveyard' lying between Chouteau's lake and Market street and 9th and 11th streets; Hell's half acre, which was formerly the basin of the lake, located between 5th and 7th streets, Spruce and Chouteau avenue; the block bounded by St. Charles, 8th and 9th streets, and Washington avenue; and a cluster of eight or ten blocks or squares, the centre of which is the intersection of 11th and Morgan streets. In these last two localities the neighborhood is to some extent supplied with wells, excavated in part in the limestone strata underlying the soil, which is here not very deep. The surface drainage has a fair opportunity to percolate the soil and mingle (very imperfectly purified, it may be supposed, by the filtration) with the well-water."

A good look at the block in question would convince one that there has not been much improvement in the surface of it since the above

date. At least a sanitarian could not be convinced that it is safer to drink water from a well on that block now than it was then.

The temptation to use well-water in the manufacture of soda-water is great because of the saving;—first, it saves the expense of filtering and distilling; and secondly, it saves the greater expense of ice for refrigerating purposes, it being necessary to have the water at a low temperature to absorb the requisite amount of carbonic acid gas, to make good soda-water.

My object in presenting this matter to the association is two-fold: first, the custom of using well-water for these purposes may not be confined to St. Louis, and some of the members from other large cities may be led to investigate matters at home; secondly, there seems to be considerable difficulty in handling these cases. While analysis of the water shows impurities, it has not so far shown enough to furnish our board of health a sufficient and safe legal reason to condemn and destroy the wells.

To a body of sanitarians it is not necessary to state that the only safe plan, in instances like these, is to destroy the wells and thereby prevent the possibility of the water being used; but this is not apparent to the manufacturers, or even always to the health authorities. Therefore I have thought that an expression from this association, while it would not be official or mandatory, would be authoritative, and make valuable reference for possible future use in attempting to abate this practice.

XLIX.

THE SANITARY MANAGEMENT OF RAILWAY CARS AND STATIONS.

By W. THORNTON PARKER, M. D. (Munich).

ACT. ASST. SURGEON, U. S. ARMY.

I desire very much to call the attention of the members of the American Public Health Association to the important subject of the sanitary management of railway cars and stations, in the hope that they may at least lend their official protest to the constantly increasing outrage of transporting patients, suffering from contagious diseases, in our railway cars, and exposing them for hours in our crowded railway stations, a terror, and oftentimes a hidden danger, to hundreds. Not only are the ordinary cars thus constantly contaminated, but the more luxurious and expensive sleeping-cars are very much used for cases suffering with whooping-cough, scarlatina, and other diseases. Patients convalescing from contagious diseases are very commonly met with. I understand that quite recently a very prominent and educated lady travelled from San Francisco to Boston, and even beyond, with children sick with whooping-cough. In this case a "private compartment" was used; but, of course, the danger of infecting other children was only lessened, not removed. Several cases of that most dreaded of all diseases of children, scarlet fever, have to my own knowledge been communicated in this way. A healthy child occupies the same seat where a convalescing scarlet fever patient has been sitting, and falls a victim to this terrible disease. Such license is an outrage on the travelling public, and should not be tolerated another day. It is for us of the medical profession to warn the public against dangers of this sort, even if we are unable to suggest appropriate remedies. In the matter of preventing the spread of contagious diseases among the travelling public, a great deal can be done, and should be attempted at once. It will be urged, perhaps, that the transportation of so many invalids of all kinds will make preventive measures difficult. Undoubtedly the number of patients carried over our railroads daily is enormous, and deaths are constantly occurring, especially in trains going to and returning from our leading health resorts—New Mexico, Colorado, Minnesota, Florida, the Carolinas, Adirondacks, etc.,—besides those which occur on other lines. I would suggest that railway station officials, conductors, and others connected with the train department, be required to prohibit persons suffering from contagious diseases from occupying cars used by the general travelling

public. A hospital sleeper could be furnished on through lines, and a medical inspector for large stations, like those in New York, Chicago, St. Louis, Kansas City, and other places. These inspectors should have the legal authority to force patients suffering from contagious diseases, or convalescing from infectious disorders, into special waiting-rooms, and, finally, into special cars. A hospital car with the least amount of upholstery possible should be the new departure in railway safety.

I offer these suggestions for the consideration of sanitarians; and I sincerely hope that such men as our esteemed president, Dr. Gihon, and others, will give the matter their consideration. As physicians, and as fathers and as good citizens, we are all interested in preventive medicine. What an important field is this to investigate and labor in! When we consider the millions travelling over our railroads, we must shudder to think of the amount of disease, misery, and death conveyed and distributed by this outrageous neglect of the most ordinary laws of decency and justice.

We all know that many diseases, like typhoid fever and cholera, have been spread over the land by the dropping of the excrement of such patients from the car privies. This subject involves everything in connection with the sanitary management of trains and railway stations.

In my journeys over this country I find our railway privies generally detestible, filthy, and dangerous. In Germany the greatest attention is paid to the cleanliness and healthfulness of railway privies, and a radical change should be instituted in this country. Our leading railway companies should be invited, urged, and, if necessary, compelled to take notice of the deplorable and dangerous state of affairs at present existing all over the country from Maine to California.

It is also to be recommended that all cars, and especially sleepers, be forced by law to be disinfected and thoroughly aired after each journey. A pretence of this is made by some companies at present, but not the satisfactory and thorough ventilation and cleansing that should be required.

The travelling public will soon respond to all efforts for their well-being; but if they are slow in appreciating such measures for their protection, then force must be used for the benefit of all. To have achieved even something in this matter will alone reflect great credit upon our honorable and useful society. That our efforts may be crowned with success, and receive hearty support and encouragement from the travelling public and our railway companies, is the sincere wish of your contributor.


MAP OF PART
OF THE
CITY OF SAINT LOUIS,
SHOWING THE LOCATION OF
Deaths from Cholera in 1866.
Prepared for 12th Annual Meeting A. P. H. A., Oct. 1884.
Scale 2200 ft. per inch.
DEATH RATE PER 1000 OF POPULATION
IS INDICATED BY ANNEXED SHADINGS
RATE 0-25 PER 1000
" 25-50 " "
" 50-75 " "
" 75-100 " "
" 100-125 " "
" 125-150 " "
" 150-175 " "
" 175-200 " "
" 200-225 " "
" 225-250 " "
RATE 255 PER 1000
" 285 " "
" 333-381 " "
" 400 " "
" 500 " "
" 693 " "
Population 1866, 204,000.
Deaths from Cholera, 3,527.
Deaths from Other Causes, 5,379.
MISSISSIPPI
RIVER
FOREST PARK
CARONDELET PARK
TOWER GROVE PARK
LAFAYETTE PARK
FAIR GROUND AND ZOOLOGICAL GARDEN
O'FALLON PARK
BELLEFONTAINE CEMETERY
CALVARY CEMETERY
HYDE PARK
EAST CARONDELET
ARSENAL ISLAND
CITY OF EAST ST LOUIS
TOWN OF BROOKLYN
VENICE
KERR'S ISLAND

L.

NOTES UPON THE HISTORY OF CHOLERA IN ST. LOUIS.

By ROBERT MOORE, C. E.

The first appearance of cholera in St. Louis was in 1832. According to Dr. Peters (M'Clellan's Hist. of Cholera in U. S., 1873, page 579) it was first brought to Jefferson barracks, a few miles below the city, by soldiers from the United States military post at Rock Island, to which point it had travelled from Quebec by way of the great lakes. The mortality was very great, rising to twenty per day in a population of about 8,000, which is equivalent to nine hundred and seventy-five in the city of to-day. But, as no record of deaths was then kept, the total number cannot be given.

Cholera also appeared here during the next year, being this time imported from New Orleans. The mortality was less than the previous year, but the absence of records makes it impossible to give any exact statements.

EPIDEMIC OF 1849.

The severest visitation of cholera in St. Louis was that of 1849, by which time the population within the city limits had increased to 63,471, as shown by a census taken in February of that year.

The disease had been brought to New Orleans on emigrant ships early in December, 1848, and in a few weeks was carried to all the principal cities on the Ohio and Mississippi rivers. During the last week in December, several boats from New Orleans with cholera on board arrived in St. Louis, one of them being the steamer Amaranth, which arrived on the 28th with no less than thirty cases amongst its passengers and crew.

On January 2, 1849, the steamers Aleck Scott and St. Paul arrived here, having left New Orleans on the 26th ult. The former reported forty-six cases of cholera on the trip, six of them fatal; the latter, twenty-six cases and four deaths. On the 7th, the steamer Gen. Jessup arrived from the same port, having had "many cases" of cholera on her trip, six of them fatal.

Each of these steamers brought many immigrants, who were landed at the wharf with all their baggage, and scattered throughout the city in boarding-houses, without the slightest hindrance or seeming care on the part of the city authorities. It is no surprise, therefore, when, in the morning paper of the 9th, we read that "several cases of cholera were reported in the city yesterday, one or two fatal." The editor adds, however, that

they were "caused by cabbage;" and to many of his readers this explanation was perhaps sufficient.

The cholera was now fairly planted, and for the next four years, including the years 1849, 1850, 1851, and 1852, it was never wholly absent from the city, except for three short intervals of about four weeks each. It did not, however, at once become epidemic. The deaths from cholera in January were thirty-six. In February they were but twenty-one, a decline which led the *Republican* to announce that there was no ground for alarm, there being "no cholera in the city." During the next month, however, in spite of this assurance, the deaths from this cause were seventy-eight, or over double the number of January; and in April there was a still further increase to one hundred and twenty-six.

All this time nothing was done by the city authorities, either to prevent the spread of the disease within this city, or to stop the stream of infection which kept pouring in from New Orleans. For example, the *Republican* of April 12 records the arrival from New Orleans, on the night before, of the steamer Iowa with four hundred and fifty-one deck passengers, mostly English Mormons, and that during the trip there had been nine deaths from cholera. Of course, in view of such facts, the disease could not help spreading, and during the first week in May the deaths from this cause amounted to seventy-eight.

By this time the city had become thoroughly alarmed. The board of health, which consisted of a physician and a committee of the council, by proclamation urged the "disinfection of back yards and damp places with chloride of lime." Even the newspapers now admitted the disease to be on the increase—"perhaps epidemic." The city was also reported to be filled with hundreds of immigrants, besides those *en route* from other states to the gold fields of California.

On the 9th of May, the circuit court adjourned for three weeks on account of the difficulty of getting jurors. Twenty-four new cases of cholera and six deaths are also reported for this day; and the same paper which contains this record notes the arrival of the steamer America, on which there had been twenty-two deaths since her departure from New Orleans. The epidemic was now fairly established, and for the seven days ending May 14, the average number of interments due to this cause was over twenty-six per day.

On the night of May 17 occurred the great fire, in which twenty-three steamboats and many blocks of buildings in the business part of the city were consumed. After the fire, the mortality from cholera fell below twenty per day for a couple of weeks, and a hope sprang up that the epidemic had spent its force and would soon cease. But it was short-lived, for on Saturday, the 9th of June, the deaths from cholera rose again to twenty-six, and on the 10th to thirty-seven. For the week ending June 17 the burials due to this cause were 402, or over fifty-seven per day.

Meantime the importation of fresh cases from New Orleans continued without abatement. On the day last named (June 17) the steamer Sultana arrived with between three hundred and four hundred immigrants.

Twenty-five deaths had occurred during her trip, and on arrival she had six dead bodies still on board.

During the next week, ending June 24, the deaths from cholera rose to six hundred and one, or eighty-six per day. By this time the alarm had deepened, until we hear of a popular subscription to clean the streets, and a patriotic citizen offers twenty dollars' worth of sulphur for purposes of disinfection. On the 25th, a mass-meeting was assembled at the court-house, at which the propriety of quarantine was at last suggested, and the authorities strongly denounced for their inaction. A committee of twelve, two from each ward, was appointed to wait upon the city council and urge immediate action. The latter body was not at that time in session, and many of its members had sought places of safety outside the city. By vigorous efforts, however, they were hastily assembled on the afternoon of the next day (June 26), and audience given to the prayer of the committee. By way of answer, an ordinance was passed at the same sitting, and approved by the mayor, Jas. G. Barry, by which the city government was virtually abdicated in favor of the petitioners. The committee of twelve appointed by the mass-meeting of yesterday, composed of T. T. Gantt, R. S. Blennerhasset, A. B. Chambers, Isaac A. Hedges, James Clemens, Jr., J. M. Field, George Collier, L. M. Kennett, Trusten Polk, Lewis Bach, Thomas Gray, and Wm. G. Clarke, were made a "committee of public health" with almost absolute power. Authority was conferred upon them to make all rules, orders, and regulations they should deem necessary, and any violation of their orders was made punishable by fine up to five hundred dollars. This authority was to continue during the epidemic. Vacancies in the committee were to be filled as they themselves should determine, and $50,000 was appropriated for their use.

The committee, thus suddenly clothed with the sole power and responsibility, at once took up their task. At their first meeting, held on Wednesday, June 27, certain school-houses in each ward were designated as hospitals, and physicians appointed to attend them. They also provided for a thorough cleansing of the city, to be begun at once, with an inspector or superintendent for each block. Among these "block inspectors," as they were termed, were many of the best citizens of the city, who entered into the work with the utmost zeal, and declined afterwards to receive any pay.

On the next Saturday, June 30, the committee recommend "the burning, this evening, at 8 o'clock, throughout the city, of stone coal, resinous tar, and sulphur"—a measure which seems to have met with much favor, for in the next day's paper we are told that on the night before "in every direction the air was filled with dense masses of smoke, serving, as we all hope, to dissipate the foul air which has been the cause of so much mortality." The committee also appointed Monday, July 2, to be observed as a day of fasting and prayer—a recommendation with which, as with that for bonfires, there was general compliance.

The committee, however, did not content themselves with prayers and

smoke alone. Thus, we are told that on Sunday the block inspectors continued their work of purification without regard to the day, and on the very day of fasting and prayer appointed by themselves, the committee dictated to the city council an ordinance, which was passed the same day, establishing quarantine against steamboats from the South; and the steamboatmen were at once notified to govern themselves accordingly. On the next day, July 3, a quarantine station was established on the lower end and west side of Arsenal island, with Dr. R. F. Barrett as visiting physician, and the detention of steamers and the unloading of immigrants and their baggage at once begun. On the 10th of July there were over three hundred people at quarantine.

Meantime the mortality kept steadily increasing, until, on the day last mentioned (Tuesday, July 10), two weeks after the appointment of the committee, the total deaths reached the alarming figure of 184, of which 145 were from cholera. After this date, however, the death-rate rapidly declined, until on the 31st of July the interments due to cholera were only three. Finally, on the first day of August, the committee of public health, in a proclamation signed by Thos. T. Gantt, chairman, and Samuel Treat, clerk, declared the epidemic to be over, and that there is no longer any danger in visiting the city. At the same time they closed their accounts (having spent $16,000 out of the $50,000 at their disposal), resigned their trust, and adjourned *sine die*.

But whilst no longer epidemic, the disease was not wholly gone, but was a cause of death in each remaining month of the year. The total mortality from this cause for the year is given by Dr. Engelmann at 4,317, or nearly sixty-seven per thousand of the population as given by the census of February. Other accounts give the total cholera deaths for the year as 4,555, or over three hundred greater. The mortality from all causes for this year is given by Dr. Engelmann as 8,495, or nearly one hundred and thirty-four per thousand.

CHOLERA FROM 1850 TO 1854.

During the next year, 1850, cholera was also a cause of death in every one of the twelve months. The total for the year is 883, of which 458 occurred in July—figures which seem small only when compared with the frightful record of the previous year; for the ratio per thousand of 1850 applied to the population of to-day, would give a mortality of over 5,000.

In 1851 the deaths from cholera reached 845. Of these, 505 occurred in June. In three months of this year—February, October, and December—there were no deaths from this cause; but in the next year, 1852, every month claimed its victims, and the total for the year was 802. During these four years, 1849, 1850, 1851, and 1852, cholera was a permanent resident, and by the most conservative report caused the death of 6,847 persons.

During 1853 the disease was wholly absent for the first time since

1848. But in 1854 it again appeared, with renewed vigor, and swept away no less than 1,534 lives, or about twelve per thousand of the population. After this it wholly died out, and gave us no further trouble until it was again imported in 1866.

CHOLERA OF 1866.

The precise route by which cholera reached the city in 1866 is not altogether certain, but it probably came by rail from New York, and not as heretofore by way of the Mississippi river. Its first appearance was in the week ending August 3, during which there were five deaths from this cause. But there had been good reason to expect it for many months. During the autumn of 1865, the governor of the state, Thomas H. Fletcher, had called the attention of Mayor Thomas to the probable coming of cholera during the ensuing year, and suggested the propriety of preparing for it. The mayor heartily endorsed this suggestion, and endeavored to get the city council to take the necessary measures. But his appeal met with no response. In the spring of the following year his efforts to this end were renewed, but with no better result. The council steadily refused to do anything. The cholera was not here, and it was argued that any measures of preparation for it would frighten strangers and injure business: so that when it finally appeared, the city was wholly unprepared to fight it. There was, it is true, a so-called board of health, which, as in 1849, consisted of a committee of the council and a health officer, but they had neither the authority nor the money, even if they had the knowledge, necessary to stamp out a pestilence.

The disease, therefore, spread with great rapidity. During the second week of its presence, it caused 120 deaths. For the third week the number rose to 754; and in the fourth week, ending August 24, it reached 991, or an average of 142 per day.

By this time the need of some vigorous and concerted measures to fight the enemy had become so great that volunteers had once more to come to the rescue. This time, however, the organization took the form of a committee of citizens in each ward, who, acting in concert with the mayor, visited from house to house, furnishing nurses and medicines to those who needed them. During the next week after the work began, the mortality fell to about one half that of the previous week, and steadily declined thereafter, until, for the week ending October 30, the number of deaths was only thirty, and a month later the disease had wholly disappeared.

The total number of deaths due to the epidemic this year was 3,527, although Dr. M'Clellan's report on cholera in the United States in 1873 gives the number of deaths from this cause in St. Louis in 1866 as 8,500 —a statement which has been frequently copied and generally accepted by the newspapers. It so happens, however, that we have two independent enumerations to guide us in this matter—one made by the board of health, the other made after the epidemic was over, by the city assess-

ors, as the result of a house to house inquiry. The total of the latter enumeration falls short of the former; but when we add to it the deaths in the city hospital as given by the books of that institution, we get exactly the same number, 3,527, as given by the board of health, so that the correctness of this figure may be considered as fully established. The rate of mortality which it represents is $17\frac{3}{10}$ per thousand of population.

The location of the deaths in this year, as given by the assessors' reports, with the approximate mortality per thousand for each block, is shown on a map which accompanies this paper. I will not attempt any discussion of the facts revealed by this map, any further than to say that it shows in a very striking manner the close relation between cholera and filth. Those parts of the city where the people and their habitations were clean, and where no wells were used for drinking-water, escaped almost entirely, and the whole force of the epidemic was spent upon those parts where the houses and the people were unclean, and well-water was in most frequent use. Whilst "Kerry patch" and "Frenchtown" show on the map in deep black, Stoddard's addition is almost blank. The man whose food and drink were free from filth would seem to have been as safe in St. Louis in the midst of the epidemic as if he had been a thousand miles away.

CHOLERA SINCE 1866.

In June of the next year, 1867, cholera appeared once more and threatened again to sweep the city. But this time a real board of health, with adequate powers and with Dr. John T. Hodgen at its head, had been organized. It is therefore no surprise that in spite of its earlier start the cholera in 1867 caused but 684 deaths, or less than one fifth of the number of the previous year.

In 1873, when cholera appeared again, it was hardly recognized as such, and the victims, as counted by Dr. M'Clellan from reports of local physicians, numbered only 392.

Whether, on its next appearance here, the death roll shall be numbered by tens or by thousands will depend upon whether the people and their officers are wise enough to profit by the teachings of the past, or shall require to be taught again by the bitter lessons of experience.

APPENDED TABLE SHOWING MORTALITY FROM CHOLERA IN ST. LOUIS.

	1849	1850	1851	1852	1854	1866	1867	1873
January	36	13	2	4	1	......	......	......
February	21	4	......	3	2	......	......	......
March	78	2	1	1	10	......	......	......
April	126	12	9	2	91	......	......	......
May	554	80	47	44	190	......	......	......
June	1,746	174	505	230	479	......	6	......
July	1,689	458	233	274	533	2	8	......
August	45	59	37	98	136	2,388	103	......
September	13	16	9	41	55	1,082	321	......
October	3	21	......	53	20	51	225	......
November	3	39	2	31	4	4	20	......
December	3	5	......	21	13	......	1	......
Total	4,317	883	845	802	1,534	3,527	684	392
Population	63,471	77,860	83,715	90,010	104,060	204,327	212,360	267,620
Rate per 1,000	68.0	11.34	10.10	8.91	14.75	17.26	3.22	1.47

REMARK.—The figures of population for 1849 and 1866 are from enumerations made by the city authorities; those for 1850 are from the U. S. census. For other years the population is computed by compound interest formula, assuming the annual rate of increase from one census to another to be constant.

PROCEEDINGS AND DISCUSSIONS AT THE TWELFTH ANNUAL MEETING,

HELD AT

ST. LOUIS, MISSOURI, OCTOBER 14–17, 1884.

TUESDAY, October 14, 1884.

The association convened at Liederkranz hall, and was called to order by the president, Albert L. Gihon, medical director U. S. Navy.

The PRESIDENT.—The first business in order is an announcement from the Committee of Arrangements by Dr. Joseph Spiegelhalter, of the St. Louis board of health, chairman of the committee. (See page 23.)

The PRESIDENT.—The next business in order will be the reports of the secretary, treasurer, Executive Committee, and Committee on Incorporation.

The SECRETARY (Dr. Irving A. Watson).—Mr. President, there is no report this morning.

The PRESIDENT.—The report of the Executive Committee will be made after the reading of the report of the Committee on Incorporation by Dr. Smart. (See report elsewhere.)

The PRESIDENT.—Gentlemen, you have heard the report of the Committee on Incorporation: what is your pleasure?

Dr. DEVRON, of New Orleans.—I move that the report be accepted and acted upon; that the recommendation made in the report be carried out, that the act of incorporation be completed, and that the committee shall consist of the president, the secretary, and the treasurer of the association, and of as many members of the association as are residents of the District of Columbia.

Dr. BAILEY, of Louisville.—Do I understand that all of the committee are to be residents of the District of Columbia?

The PRESIDENT.—Of course, not all the members of the committee are to be residents of the District of Columbia, but those who are residents are to be members of the committee.

The motion was carried.

The PRESIDENT.—We will next hear the report of the treasurer, Dr. Lindsley.

(Dr. Lindsley read the report elsewhere given.)

Dr. DEVRON.—I move that the report be received, and that it be referred to the Auditing Committee.

The report was referred, and the president appointed Drs. Devron, Bailey, and Bell the Auditing Committee.

The PRESIDENT.—Next in order is the announcement from the Executive Committee of the names of persons recommended for membership. The secretary will please read them.

Dr. Irving A. Watson, the secretary of the association, read the list of names recommended.

(The names of all persons elected to membership will appear in one list following the proceedings.)

Dr. Joseph Spiegelhalter, chairman of the Committee of Arrangements, read a local list of persons recommended by the Executive Committee for membership.

Dr. DEVRON.—I move that the gentlemen whose names have been read be elected members of the association.

Carried.

Additional names were then sent up by members.

The PRESIDENT.—These names, of course, will have to go before the Executive Committee. They will be acted upon and reported to-morrow.

Mr. BROOKS (First Vice-President).—Mr. President, on behalf of the Executive Committee I offer the following resolution:

Resolved, That a cordial invitation be extended to the members of the National Board of Charities and Corrections, now in session in St. Louis, to attend the meetings of the American Public Health Association, and that the president of this body be requested to extend such friendly invitation to the National Board of Charities and Corrections.

The resolution was carried.

The PRESIDENT.—I have just received a communication from the board of directors of the St. Louis Mercantile Library Association, inviting the members to visit that association during their stay in this city.

The secretary will now call the roll of the Advisory Council; and where a state is not represented, I will be much obliged to the members if they will send in nominations to fill the vacancies. It is very important that the Advisory Council should be filled.

Secretary Watson called the roll of the council.

The PRESIDENT.—Now, gentlemen, next in order will be the reading of papers, unless there is some miscellaneous business that any member desires to offer. We have a few minutes of time to spare for that. There being no miscellaneous business, I will call on Irving A. Watson, M. D., secretary of the state board of health of New Hampshire, to read the report of the Committee on Necrology.

Dr. Watson then read the report of the committee, which is found elsewhere.

The PRESIDENT.—The next paper on the programme is that of Maj. Samuel A. Robinson, A. M., of Washington, D. C., inspector of plumbing of the District of Columbia, on "The Hygiene of the Habitations of the Poor."

Mr. Robinson not being ready, the reading of his paper was passed for the present, and a paper prepared by Charles W. Chancellor, M. D., of Baltimore, Md., secretary of the state board of health of Maryland, was read by that gentleman. (See page 145.)

The PRESIDENT.—Maj. Samuel A. Robinson will now read his paper entitled "The Hygiene of the Habitations of the Poor."

Maj. Robinson then read the paper mentioned. (See page 152.)

The president then read an invitation from Henry C. Ives, Esq., director of the Museum of Fine Arts of St. Louis, inviting the members of the association to visit that institution; also a communication of a similar import to visit the Washington University.

The PRESIDENT.—I will now call on William K. Newton, M. D., health officer of the city of Paterson, N. J., to read a paper on "The Sanitary Survey of a House."

Dr. Newton then read the above named paper. (See page 159.)

The PRESIDENT.—The subjects covered by the three papers which have just been read is open for discussion. The Executive Committee has decided to limit the discussion to five minutes to each member.

Dr. HUNT.—I think this session could not have been opened more properly than by a discussion of the subjects presented this morning. I have been very much interested in all of these papers, because they have thoroughly canvassed the whole subject. The first paper, treating of the condition of the dwellings of the poor, was of especial interest. The second paper, which gives a most excellent *resumé* of our present knowledge of the whole subject, was also interesting. I desire to draw attention to two or three points. One point is the decided opinion given by Maj. Robinson as to the proper closets for dwellings. I believe the gentleman is right in pronouncing what they have been in the habit of using in the District of Columbia, the open closet, the best. I believe those closets are declared the best now in the market. There was one other point in the paper to which I wish to draw attention, and to make an inquiry, because I was not quite satisfied with it,—that is, in regard to the prevention of dampness in cellars. The gentleman said that in draining cellars in houses, while introducing the drain into the sewer, we should be very careful how we connected the drain with the sewer; but he did not state precisely the method by which this should be done. Now it is an open question, whether, in attempting to drain a building, we should introduce the drain into the sewer at all. As the gentleman has the right to speak with authority, I should have preferred that he should have told us just how it should be done. The point is not a very easy one to understand. The second point, which is often met with in the books, and yet as to which I think there is some doubt, is as to the method of keeping out the dampness of cellars arising from the ground. I doubt if we can keep it all out in the way he suggests. I believe a pavement is of great value to a damp cellar; but I should like also to have enough facts to furnish evidence that we can, by that means, keep out this dampness. There are many other points in this last paper

which are excellent, and which give us in detail what an inspectoı should inspect, to correctly accomplish the object he has in view. In reference to this subject of tenement-houses, I will say that I have this summer made an examination of some houses in London for the purpose of ascertaining these details, and to learn how we should best accomplish the building of houses for the poor. The poor do not know how to keep their houses. When we build these large buildings we should put an overseer there, and supply them with chutes, so that everything can be removed from the building, and give them facilities which the poor cannot have for themselves; and give them a kind of organization and method by means of a sanitary inspector, who will keep the house for them. I think that that would be a great relief, and of great value to the system of tenement-houses. I have experienced very great gratification in listening to all these papers, and I draw attention to these two or three points, because they are the only ones to which I could find that there might be any exceptions taken.

Maj. Robinson.—On the subject of the connection of sub-soil drains with the sewer, I have endeavored to explain that there should be no direct connection between them. These drains should be made of tile, with open joints at the top, having loose covers, and connected with a small well, where it is not practicable to carry them outside of the house. This small well, into which this drain should go, should be connected with the sewer by means of a three-quarter inch lead pipe. The well should be connected with the sewer, and have a Cudell trap to prevent the return of the sewer air into the house. That would cut off connection, and it would protect the well from sewer air.

Dr. Hunt.—I think great care should be exercised to prevent the return of sewer air. That idea was not developed in that paper, as I understand.

Maj. Robinson.—That is managed by the pipe and Cudell trap, connecting this well with the sewer.

Dr. Hunt.—In many cases the drain would be lower than the sewer. How would you accomplish it then? How would you accomplish it where, as you suggest, there would always be this flow of water?

Maj. Robinson.—Where it is higher, we can drain it into the sewer; where it is lower, then we must drain it into the well, and pump it out. That is my idea of protecting a cellar from dampness where it is connected with the sewer. Broken stone and sand, with three or four inches of Portland cement on top, I think would keep out the ground air, and prevent dampness from rising to the surface.

Dr. ———.—I understood you to say that you would recommend the ordinary agricultural tile for this purpose?

Maj. Robinson.—Yes.

Dr. ———.—Is that ordinary burnt clay, or is it glazed on either side?

Maj. Robinson.—It is not glazed.

Dr. ———.—It is just like a brick would be?

Maj. Robinson.—Yes.

Dr. ———.—Mr. President, I wish to occupy just a minute, sir, upon that very subject of house drainage especially. You must bear in mind that a large majority of the people in this world do not live in cities where they have sewers to drain into. It is a good deal easier to drain a house where you live in a city like this, or in Washington where Maj. Robinson lives, than in the country towns where they have no sewers. In many country towns, and not so small either, say where they have ten thousand, fifteen thousand, or twenty thousand inhabitants, there are no sewers, and you could not therefore accomplish any such thing as is here supposed. I make this statement with a view of recommending what the gentleman says about the tile. I believe that is good, for the reason that it not only drains the house, but it drains the soil on each side of it. It drains the earth around the house, and it can be carried, to my own personal knowledge, any distance you please, and run into an ordinary well. I wish to say further, in draining a house, where you drain the refuse from it, that I commend the tile with the most perfect confidence, and do it for the very reason that it is capable of absorbing the water, and it will not block as the drainage tile will. I have known some of them to be used for at least five or six years, and they run as many as four hundred feet, where all the refuse from the kitchen, including wash waters, was poured into it; and still, for that length of time, I did not find a single instance of blockage. I think it has the power of washing itself. I might state further, that I am of the opinion that the advantage it has over glazed pipe is, that nothing can get into glazed pipe except what you put there. It creates a vacuum in the earth, and one will block and the other will not block.

Hon. Erastus Brooks.—I should like to say a word upon a single item under discussion here to-day, that is in regard to plumbers. My experience of that distinguished class of our citizens has wrought an opinion which I think, so far as they are concerned, amounts almost to prejudice. In relation to plumbers: I have often said to my own plumber, that whereas theology prescribes a certain place for the good and for the evil people in the future, there really must be some special place prescribed for plumbers. [Laughter.] Just what that place is, of course no human body can determine. In the city of New York we have passed a law that requires that plumbers should be licensed, that none but a qualified plumber should serve in the important capacity in making proper provision for the sewerage and the drainage of a house. Now the plumbers of New York fought that bill tooth and nail while it was in the legislature. They resisted it with all the moral, physical, and political force which they could bring to bear upon the members of the legislature. But it has now been a law for three or four years, and the licensed plumbers, that is, the qualified persons, are the most zealous and active defenders of this very law, for the reason that they desire to crowd out the incompetent person and to perform the work themselves. Now I commend this law to those who reside in other cities. It seems to me that a license should be as necessary for a plumber, intrusted with the

important work committed to him, as it is necessary for a physician to have a license, for I think a great many more lives are destroyed by bad plumbing than there are by bad doctors. [Laughter.] A great many more lives might be saved by good plumbers than by good doctors. I wish to commend this part of the subject discussed here to-day. In discussing questions of this importance, it seems well for every man to put himself in the place of the other man: and when you undertake to discuss what is proper for the country and what is proper for the town, you cannot apply uniform rules to different places. In the country, the custom is to put the closet about as near the well as is possible, and as is convenient. This is one of the bad practices which results in so much impure water and so much disease throughout the country. There ought to be some rule for keeping these two things just as far apart as possible. [Applause.]

Dr. Reed, Mansfield, Ohio.—There is one point that I wish to call attention to, and I will be as brief as possible. The second paper made this remark: "Rules ought to be enforced to secure proper sanitation among the poor." I endorse that; but we have got to go back of all that before we are able to enforce rules. As to the opinions of our distinguished friend who has just had the floor [Mr. Brooks], I acquiesce with them most fully. In some recent sanitary work that I was obliged to do in our city, it was my fortune, or misfortune, whatever it may be, to have communication with a number of distinguished sanitarians of this country. It was my experience, in asking the same questions of different ones, to get decidedly different answers. Now, before we can enforce sanitary rules among the poor, we must have those poor people educated to a certain extent up to the rules that are to be enforced. Before we know what rules are to be enforced, we must have the proper parties who make those rules united as to what those rules should be. In our state we have a bill pending at present to license plumbers. The main argument brought against that by the people of our state, and by intelligent men there, is, that no two plumbers are agreed on the same subject. Now who is to be the authority? How are we going to accomplish this work? How are we going to get at it? We have no proper schools in our state—I do not speak for other states, but I suppose they are in the same boat that we are—there are no proper schools in which to educate our sanitary engineers. People are educated at the old schools or at the new schools, and as we are better educated we become united in certain things. As to the manner in which certain things discussed here should be accomplished, our sanitary engineers do not agree. We ought to have schools established by state authority, that ought to have the object in view of approaching a unit as to what rules and what sanitation ought to be adopted; and after we have those rules adopted, then we ought to have text-books collated from the teachings of those schools, and put into our public schools, and taught to our children as we teach them music, arithmetic, and other branches in the public schools, so that they may know what is proper and what is not proper. Then we

can fully carry out the remarks made by the gentleman as to enforcing proper sanitary laws in our state.

Dr. Fee, of Kansas City.—There is one practical question in regard to this subject of house-drainage which the gentleman omitted to give, or about which he said nothing. That is in regard to the traps. I would like to ask the gentleman whether he prescribes a separate vent pipe for each trap? That is a practical question which has not been discussed a great deal.

A member.—Mr. President, I suggest, where a number of questions are propounded in a discussion, that the writers of the papers be permitted to answer them all at one time. By that means we will save time: otherwise I do not see how we are to get through with our debate.

The President.—I propose to give Maj. Robinson the balance of Dr. Fee's five minutes.

Maj. Robinson.—In accordance with the methods formulated by different cities of the country, Washington city being in the lead, and Brooklyn and New York city following, and other cities since that time have adopted the same regulations, it is required that an iron pipe shall run under the house, there shall be a running trap at the front, and fresh air ventilation inside of the running trap. It is prescribed that the air pipe shall extend above the roof of the house, and there is a circulation of air created between this fresh air inlet and outlet, and every trap shall have separate ventilations. Every fixture shall have a separate ventilating pipe, either connected with the soil-pipe or carried separately to the roof of the house to prevent syphonage and the decomposition of organic matter in the pipes.

Dr. Bell, of New York.—There are two or three suggestions in these papers that have been read that I think it would be well to call attention to. I believe that the great fault of sanitation in various municipalities is this: we are all the while dealing with consequences and making public inspections, instead of going to work and finding out the cause of the mischief and preventing it before it occurs. It has been stated by my friend from New York [Mr. Brooks] so pointedly in regard to the plumbing law, that it would be almost impossible to believe that we could make anything better. But I assure you that we still have many reforms to accomplish. I want to ask why it is that we have six or eight weeks of pioneer work every year in the city of New York? Why are we compelled to fight typhus and typhoid fever six to eight weeks every year in the great city of New York? I have no doubt that a system of inspection would save six or eight hundred lives every year. There are long months of sickness preceding death. I appeal to you to know how many years of sickness are represented by these six or eight hundred lives? We are told by some of the most distinguished statisticians, that each death represents two years of sickness. As it is now, when a death occurs by typhoid fever, a sanitary officer is sent to see why he died of typhoid fever. Why didn't he go there to see if there was something that would kill a person before he died? These cases occur in small

towns and villages everywhere. Their health officers have insufficient authority, it may be—and we ought to aim to cure that; or may be the health officer has found no member of the board of health at all. In that case the community have to depend upon such sanitary measures as may be adopted by the city council acting upon reports made by some non-professional citizen. They have health officers, so called, who are not persons skilled in science and informed as to the most advanced system of sanitation. All this should be changed. I want to say a word in regard to cellar basements and damp ground. The plan mentioned by the gentleman for the plumbing I do not regard as any way perfect at all. I have found by my experiments that ordinary brick and cement will allow the air to come through. We all know that such a floor will hold about 7 per cent. of water, ordinarily. Now if that is true, water will get through wherever this porosity exists. I have a great many times been consulted in reference to these things, and I have suggested what I believe is uniformly the most effective damp proof floor that can be made. This is made of brick laid in a mixture of coal tar and asphalt. I have never known water or air to go through such a combination as that, and I don't believe it can.

Dr. Raymond, of Brooklyn.—I have had occasion recently to compare the plumbing works in most of the large cities of this country. While I find a great diversity of methods in constructing the traps and in ventilation, I also find much dissimilarity in reference to the connection with house sewers. Those who live in large cities, and who have had occasion to examine the plumbing of later times, have invariable found, where the main sewer was constructed of earthen ware, that in a majority of the cases the pipes have either been broken by the settling of the ground, or opened at the joints by imperfect joining at the time of construction; so that I think at the present time that earthen pipe which is porous is absolutely prohibited for the removal from the house of waste material. Now, if I am not mistaken in the remarks which have already been made in some of the papers, a distinction has been indicated between drains used for the removal of water and those to carry away human waste. The agricultural pipes referred to were intended simply to drain the water from the soil beneath the house, and it is therefore stated that it was desirable that the pipe should be porous. I did not certainly understand the gentleman in his paper to suggest the use of such porous pipe for the removal of waste material from a house. If a pipe is sufficiently porous to admit of the draining of the soil from without inward, it would, of necessity, permit the escape of the contents of the pipe outward; and it is my experience that were pipe of that kind used, the earth would become saturated more or less with filth. It is claimed by the manufacturers of earthen-ware pipe that they have been unable to manufacture pipe of an impervious character, and the joints in the pipe cannot be made as safe as the joints of iron pipe. Now the practical question I would like to ask municipal authorities, and authorities who have had experience in this matter, is, whether any experiments

have been made with this class of pipe. There is a kind of pipe made at the present time known as vitrified pipe, which will stand any amount of pressure, and no material can pass through it, and the joints are so tight that it is impossible that the soil should become contaminated. Most of the sanitarians throughout this country recommend the use of iron pipes, and as has already been stated by a gentleman who read one of these papers, there is great similarity in the language used in framing these rules. So similar is the language used in framing these rules, that there is a suspicion that they are taken one from the other. One board of health has established a system of rules, and another board of health has taken up that system and changed the rules so as to make them apply to that particular locality; and in that way iron pipe is introduced all over the country. Another thing: I find that very many of these systems require the use of tarred pipe. Now it is a matter of experience that the poorest kind of iron pipe in the market is tarred pipe. Pipe which contains sand holes and imperfections of that kind, which can be seen if the pipe is not tarred, are covered over by this tar. We find that pipe which could not be sold in the market is tarred and then sold; so that one of our rules which originally required tarred pipe has been so amended as to prohibit tarred pipe. Now I would like to ask, as it seems to me the most practical point which has come up here in this discussion, inasmuch as we are all interested in the subject of drainage and ventilation,—I would like to ask if there is any board of health which will give any statistics which go to show that any experiments have ever been made with impervious, vitrified glazed pipe where it has been used for house sewerage.

Dr. Briggs, of St. Louis.—I wish to notice a point in one of the papers which, at a distance, might give a false impression. An allusion was made to the condition of the city of St. Louis when it passed through the epidemic of 1849. I would simply suggest that when that paper is printed, attention be called to the fact that St. Louis is in a very different condition in 1884 from what it was in 1849. Since that time we have had an opportunity of putting in drainage on improved plans. As a matter of fact, as matters now exist, the cities of the West have a certain advantage over the older cities of the East. They do not have the remains of the past to be cleared away. We, with our water-supply, may see a sanitary future as bright as almost any other city in the Union. I would not like to say anything that would have a tendency to check our local sanitary work in which we are continually engaged, yet we have as many advantages for that purpose as anybody.

The President.—The time we can give to the discussion of these papers has passed. We will now proceed to the reading of the second series of papers.

Dr. George H. Rohé, of Baltimore.—Mr. Chairman, I desire a few minutes' time for the preparation and the distribution of some tables.

The President.—As Dr. Rohé requires some time for the preparation and distribution of some tables, the discussion may proceed a few minutes longer.

Dr. Devron, of New Orleans, La.—The sanitary survey of the city of New Orleans is as complete as that of any other city. In New Orleans, if any person desires to rent a house, he can proceed to the office of the board of health or of the sanitary association and consult the record, and immediately find the number of rooms in the house, the quality of the water, the previous history, mortality, and health of the house. This continual inspection is useless unless you can cure the defect. The way to cure the defect is to leave the house idle in the hands of the landlord.

Dr. Bryce, of Toronto.—I wish to make one remark to the association with reference to the survey of a house. I may say that we, as a state or provincial board, have carried out the suggestions practically, made by Dr. Newton, as a province, by having a printed memorandum-book with a series of questions very similar to his, and we distribute them through our 700 municipalities. I am free to say that a number of our municipalities, in the short time our health board has been in force, have taken advantage of the opportunity, and have adopted these inspection books, and have gone to work in many of the larger places and have established a complete and thorough house inspection. There is one other point to which I wish to call attention. It was brought to my mind by the statement of Maj. Robinson concerning asphalt and cement in the bottom of cellars. Of course it might be true that a certain amount of bad air might be able to get through it under certain circumstances. I do not think Maj. Robinson has fully shown that it is sufficient in house drainage, or, rather, in the drainage of the soil. If the drainage of the soil be complete, we can tell perfectly well if it is dry by the asphalt's being dry. If the asphalt is damp, certainly the drainage is not complete. If the drainage is complete, then the danger from the decomposition of any matter would be largely obviated, and any danger from that source which might possibly occur would be largely prevented.

Dr. Cook, of Nashville, Tenn.—Mr. President and Gentlemen of the Association: I have not had the pleasure of attending the meetings of this association since it met in our city some six or seven years ago. As the health officer of the county in which Nashville is situated, I have been especially interested in the papers read by Maj. Robinson, of the District of Columbia, and others. I believe the discussion has taken the range so as to embrace the proper drainage of habitations. That, certainly, is a very excellent theme, and I have been delighted with the views which have been presented this morning. As the health officer of the district in which I live, I have been compelled to visit many of the habitations of the poor, where they have not so much as a pipe, or drainage of any sort. One of the principal difficulties which besets the health officer, not only in Nashville, but in almost every large city of this country, is that which is connected with a large portion of the population which exists outside of the corporate limits of the city, and who have no sewerage connection whatever with the sewers of the city itself, so that it is quite impossible to have any drainage of any description into the sewers

of the city. Hence, under the heading of the "Hygiene of the Habitations of the Poor," it becomes us to pay some attention to, and look at, the difficulties that stand in the way of people who live outside of the corporate limits. In those places that are not sewered and are not drained, we are necessarily compelled to submit to much effluvia that grows out of the accumulation of decaying matter on the surface of the earth. We have no sewerage and no drainage among that class of people that live outside the corporate limits. It is in localities of this sort that we must expect diseases of a virulent character. Take the experience of Nashville during seasons when she has been afflicted with cholera, and we find this disease located principally among the class of people that have not the advantages of sewerage. Most of the difficulty arises in those houses on account of defective ventilation and sewerage, and a lack of cleanliness in the habitation. I was particularly struck with the remarks of Dr. Bell, of New York, in which he said it was important that we should send some person to find out what the difficulties were, and have them removed before fatal results followed. Gentlemen of this Association, I take it that is the basis upon which this association rests. If we desire to be successful, we must lean upon the strong arm of the civil law. We must rely upon legislation for assistance. When you have a sanitary inspector, and find out what the difficulty is, you should have authority to remove it. But how can we do it, sir? The very first step is to appeal to the civil law of this country, as I undertake to say, to carry sanitary officers and inspectors forward in this work, and enable them to investigate and remove the difficulties found. I pray you, Gentlemen of this Association, that the sanitarians of this country, by the right of labor and intelligence, have the right to advocate the measures that control the health departments of this country. I undertake to say to this association that the men who have devoted their lives and attention to sanitary matters have the right to appeal to the public to get their sanction to control sanitary matters in preference to any other class of people, so that this association and the medical associations throughout this country will have boards who will have authority above all other classes of men, and the right to conduct and shape the policy of the law upon sanitary matters. We know our association should determine the necessary laws in a given department, and should control the sanitary inspector and the plumber in the performance of their work. In this work they should have the right to dictate to the law-making powers anything that will make it complete. (Applause.)

The PRESIDENT.—The paper on "The Hygiene of Occupations," by George H. Rohé, M. D., Professor of Hygiene in the College of Physicians and Surgeons, Baltimore, Md., will now be read.

Dr. Rohé then read the paper. (See page 165.)

The PRESIDENT.—The next paper will be read by Adolph Alt, M. D., of St. Louis, Mo., editor of the American Journal of Ophthalmology.

Dr. Alt then read the paper on "Protective Spectacles for Working Men." (See page 262.)

The PRESIDENT.—The next paper will be on "Heating and Ventilation," by Professor Charles O. Curtman, M. D., of Missouri Medical College.

Professor Curtman then read the paper. (See page 253.)

The PRESIDENT.—In the absence of Acting Assistant-Surgeon W. Thornton Parker, U. S. A., who has prepared a paper on "The Sanitary Management of Cars and Stations," the paper will be read by Dr. Conn, president of the state board of health of New Hampshire, who has kindly consented to read it.

Dr. Conn then read the paper. (See page 335.)

The PRESIDENT.—These papers are now open for discussion.

Dr. CONN.—As the time has now come for the discussion of these papers, I wish simply to call the attention of the association to the practical application of the paper last read, as I believe it is of the first importance with reference to our leading lines of travel, which are supplied with the celebrated Pullman cars that run the length and breadth of our country. Travellers upon them often pass two and three days and nights upon the road. Any man who has travelled across the continent knows in what a filthy condition they get to be in before he arrives at his journey's end. Now I believe a company like that should have its organized sanitary head, like any other department in railway business, and that that particular department should have a medical man at its head, who should be the medical inspector of these cars and have the sanitary care of them; and I believe that any company, like the Pullman company, that will organize such a department, will save in the course of the life of that car enough to pay the expense, and the travelling public will appreciate the effort on their behalf to that extent that the increased travel will pay all the costs and expenses that might arise from the inspections.

Dr. MCCORMACK, of Kentucky.—At a sanitary conference recently held in my state a valuable paper on the "Sanitation of Railway Depots" was read, which called my attention to this subject, and that has made the paper of Dr. Parker one of especial interest to me. The author of that paper, who had paid considerable attention to the subject, and who had made a careful inspection of a large number of railway depots, pointed out in a very plain and direct way many of the serious defects, both in their construction and their management. This was especially applicable to the depots of the smaller cities and towns, although not inapplicable to those of larger places. He pointed out a fact that these depots were usually built over a side drain alongside the railway. These drains usually pass immediately under the passenger platform; that in order to escape the dampness of the soil and mud ensuing from the drainage and from the roof of the depot, a ditch is dug alongside the embankment. The drippings from the roof in the time of showers, and even during heavy dews, are sufficient to keep the soil under the depot continually moist. In addition to that, the discharge of urine from the privy accumulated under the depot, so that in a large majority of instances—I believe he said there was no exception so far as he had been able

to find—these discharges had accumulated for years, no attempt being made to remove them, and no provision being made for that purpose. There was no way of getting a passage-way under the depot that they might be removed, so that this soil, poisoned with these discharges of urine, and continually damp by these discharges and by the moisture from the roof, was made the best possible bed for the development of any disease germs that might be implanted in them. It seems to me that this subject is one of especial interest just now, in view of the possible incoming of the cholera during the present season. We know that different lines of railroad run throughout the country, and that in this respect they are about alike. With just such soil as we know exists around a very large number of our railway depots, we know we have the best possible hot-bed for the reception and development of cholera germs. While I do not know that any definite action could be taken by this association, it seems to me that the point should be insisted on in the presence of the representatives of the state boards of health and the municipal boards of health here assembled; and that you take, by some pointed action, measures to secure such action as will cure these defects, or will induce the railroad companies to remedy them. At least, I think something might be done to mitigate this great evil.

Dr. Bell, of New York.—Mr. Chairman, one single word. I have lately had my attention very much drawn to this subject. What Dr. McCormack has said has simply been an endorsement of my own thoughts. Any change in this matter should be done outside of the railroad companies. They do not know any more about preventive measures than other people, and I think the initiative should be taken by us. If the initiative is not made by sanitary men, it will not be made anywhere. My observation and experience for five or six years, during which it became my duty to inspect a great many railroad depots, have been, that in some cases I found that the vaults were filled with the accumulations of some years, and a large amount of filth had collected. In some cases this filth was covered over with a few tons of earth, and the privy moved to another place. State boards of health are now organized in almost all of our states, and I think that local boards should be put on a more effective footing. There is another question that has been alluded to this morning which is embraced in this pioneer work. It is well known to us all that scarlet fever may be communicated in cars. I have myself known of a case of small-pox in one of these coaches. At the time it was not suspected, but afterwards the traveller developed a case of genuine small-pox. Now these evils ought to be prevented. I think the point about this discussion is, that it belongs to the boards of health to take the initiative in this matter.

Dr. Hunt, of New Jersey.—I desire to make a remark or two upon two or three points that have been introduced in connection with this series of papers. It seems to me that we need more statistics on some of the subjects mentioned. Dr. Rohé presents us a table in which he enters somewhat into statistics, but they do not extend far enough, it

seems to me, to be of great value. If there are any statistics that are unreliable, they are such statistics as these. The compilation has been faithfully done, but the material at hand is inadequate. The statistics presented here are not now nearly as applicable as when they were first collected. A man may change his occupation. I would fall back entirely upon records of marriages rather than upon the records of death, because at the marriageable age a man generally has a settled occupation. We shall never have proper statistics until we have an inspector who will collect figures for us that will not only give us the occupation of the individual when he died, but what he did when he lived, and tell us how many years he was engaged in that occupation. Then you have only to refer to these facts to see how thorough these statistics are. We must have a different set of statistics from these. They must be tabulated from an entirely different standpoint than from the present.

One single word on the valuable paper in reference to ventilation. It calls our attention very strongly to the causes of imperfect combustion. I am satisfied that a great deal of evil in our houses comes from that source rather than from the mode by which heat is introduced. I had a discussion recently with, and I got a good deal of information from, a gentleman who is the inventor of one of the best furnaces in the country. He insisted upon it that in my own furnace there was no necessity of supplying it with air. I am very glad, sir, that this gentleman has so pointedly fastened our attention to the importance of the most thorough supply of good air for combustion.

Dr. Fee, of Kansas City.—I would say, in Kansas City, in the year 1882, we very frequently got cases of small-pox on the cars from the west. I have known men to come in on the train, and go at once to a small-pox hospital. In 1882 a man bought a ticket at Fort Scott, and on his arrival was sent immediately to a small-pox hospital. In none of these instances was the conductor aware of the fact that the traveller had the small-pox. Wherever the conductor became aware of it, the patient was side-tracked.

Dr. Armstrong, of Memphis.—I wish to make an addendum to the remarks of the gentleman who read a paper a few moments ago on "The Hygiene of Occupation." Those statistics referred to doubtless embrace many men without fixed occupations. It has been my experience for a considerable number of years, on the Mississippi river, that we have a great many men following an occupation on the river as long as it is a profitable one. In the summer-time these men would go to the cotton plantations, and in the fall to the sugar-houses, in the South. Later on they would go to steamboating. I do not think that any number of cases of consumption that would be reported statistically would be correct among the firemen on the Mississippi river steamboats, for the reason I have stated. If a fireman died of consumption, it might be a case which was contracted while engaged in some other occupation.

Dr. Reed, of Mansfield, Ohio.—There was one point in regard to railroad sanitation that I think deserves our attention, and that is the fact

that county and township officers should not be allowed to send sick persons from one point to another, in order to get rid of them, thus giving an opportunity for the spread of disease. A number of these instances have come under my observation, not particularly where they were cases of contagious disease, but it was not their fault that they were not contagious. If they had been contagious it would have been all the same. When a travelling man is taken sick in any township, it is the custom among many of the township officers, if he is not so sick as to be confined in bed, to put him on the cars and ship him to the next township, or to the next city, as the case may be. They will take him off the train, and then ship him along again. If the disease is scarlet fever or whooping-cough, they transmit this along the line of the road. Now I think there should be some law to prohibit township officers from doing this. In cases of this kind the township officers or the township physician should be authorized to give the party a certificate or a pass, when he is in such a condition as not to transmit the disease.

Dr. Cook, of Nashville.—In order to illustrate the importance of the subject introduced by the gentleman that wrote upon railroad sanitation, I will relate a fact that occurred in Jackson county, Tennessee. Small-pox was introduced there from Memphis. I believe it was in March, 1882, as I stated in a report to the state board of health of recent date. That was the beginning of a scourge of small-pox which has lasted the county and city of Nashville together more than two years, and has caused an expense of $125,000 to $130,000. I know of some instances where cases of small-pox which originated in that city went elsewhere—all of which goes to show the vast importance of railroad sanitation. I can conceive of no paper of more practical importance than that produced here this morning upon that great subject; and furthermore, Mr. President and Gentlemen of this Association, I must repeat what I said before, that I know of no men or class of men who have so good a right to act in the premises to the extent this association requires, as a state board throughout the country. As Dr. Bell has said, it is not so much the railroads that are at fault, as the local sanitary officers and state boards of health. I think we should attract the attention of sanitarians throughout the country to the importance of legislation upon this subject, and if necessary arrange in some way with the officials of the road to prevent one section of the country from imposing diseases of a contagious character on another section.

Dr. Thornton, of Memphis.—I rise merely to call attention to the rigid and stringent orders that have been issued by the Tennessee State Board of Health, in regard to the manner of the shipment of contagious and infectious diseases from the state, and also to the transmission or shipment of the remains of parties who have died of those diseases. It has been the endeavor of the Tennessee State Board of Health, for the past seven years,—and for the last two or three years especially,—to enforce these regulations in the most rigid manner; and I think, sir, that we have about perfected and carried out this arrangement as well as most

any state. Dr. Cook speaks authoritatively, and according to the record, no doubt, about the introduction of small-pox into Nashville from Memphis. My impression is that the small-pox,—and I made the official report to the state board of health, being the chairman of the committee on infectious diseases for that board,—my impression is that the disease was conveyed there from Milan, Tenn. It was introduced into Nashville from the little town of Milan. However, that is not important to the issues here. In regard to the spread of small-pox in Nashville, this is not the time nor place for me to make criticisms upon the spread of that disease there. I will have to do that, doubtless, in the report I have yet to make. It is not very creditable to the sanitary authorities of that city, especially as Dr. Cook at that time was not in office, that it did spread there to a very great extent, and I think, sir, to a very unjustifiable one. The disease could have been controlled more effectively than it was. In regard to the sanitation of railroads, that comes within the province of the local boards of health. A good deal can be done in that respect. I think, so far as local sanitation is concerned in supplying the railway coaches, the travelling public should at least have proper drinking-water. This is one thing where I think a reform is needed. In many places the water-supply is very inferior.

Dr. Rohé, of Baltimore.—I was well aware that the table I referred to was an incomplete one, and one that perhaps was not of much value in establishing the injurious effects of certain occupations. I perfectly agree with Dr. Hunt that we need to reconstruct our statistical tables bearing upon the effect of occupations upon health. I agree also with Dr. Armstrong, that any statistics upon the mortality of firemen and coal handlers on steamboats must be considered with reference to the previous occupation of the same individual. I believe we ought to have an inspection of factories, as Dr. Hunt suggests. For that very reason we should have a reconstruction of our tables. The table covers a considerable number of occupations, and extends over a considerable number of years. It is not complete by any means, but the tables of Hert and the later researches of Markel are the only important figures we have upon the subject, and since we cannot rely upon them absolutely, I suggest that in this country the subject ought to be investigated, and investigated practically. I do not think the paper I read was the sort of a paper that ought to come before the association. There were no facts on the subject available, and the brief time I had to prepare the paper did not give me the opportunity of making any personal investigations. Even if I had made personal investigations, they would have been of small value, because an investigation of three or six months would be perhaps of little use. I think, if a part of the association were to work constantly upon that line for a considerable length of time, some valuable results might be obtained in the future; and it was merely to call the attention of the association to the matter that I read the paper.

Dr. Hunt.—Lest I may leave the impression upon the association that I was reflecting upon the state board of health of Tennessee, I desire

to say that I have no such intention, nor do I suppose that Dr. Thornton thought so. On the contrary, I desire to say, so far as small-pox is concerned in its career in Nashville, that about all the good that any local authority has done in that city has been done by the state board of health. I give them all the credit. I look upon them as efficient and most excellent men, and it has given me pleasure to coöperate with them in carrying out their instructions, so far as possible. The state board of health, using the machinery of the local board, did not act as efficiently and rapidly as it might have done. In my report, in giving the career of the disease, I merely show by the figures that the disease steadily increased from July, 1883, to March, 1884. In March, 1884, the executive committee was directed to carry out certain instructions, which it did under certain penalties. The disease began to disappear rapidly. This result is an argument not only showing the wisdom and efficiency of the state board of health, but it also shows that under the administration of wise sanitary laws, many diseases may be either restricted or terminated.

Dr. Stillwell.—Mr. President, I congratulate you and this association upon the fact so strongly emphasized to-day in one of the papers read before you in regard to public sanitation, beginning in the community at the home, and extending from thence to a general renovation. I believe this marks a new departure in the modes of sanitation. I venture the prediction that if any portion of medical science shall ever be accounted among the exact sciences, sanitation will be the first to reach the goal.

The President.—Before we close the morning session, allow me to state that there will be no general session this afternoon. There will be a session of the members of state boards of health in the small room at the end of the hall at 4 o'clock. To-morrow we will have three sessions, and I beg of you to be prompt, for unless you do so, we shall not complete the very long programme we have announced, which embraces some very excellent papers. The association will meet at 9 o'clock in the morning, and I hope you will all be punctual. To-morrow afternoon there will be a session devoted exclusively to state board of health business. It is intended that the prevention of cholera shall be the prominent subject of consideration. The committee which I was requested to appoint to convey the resolution of this association to the Convention of Charities and Correction, will consist of Hon. Erastus Brooks of New York, Dr. G. P. Conn of New Hampshire, and Dr. T. Grange Simmons of South Carolina.

On motion the convention adjourned to 8 o'clock p. m.

EVENING SESSION.

MUSIC BY THE ORCHESTRA.

Reception March, ... Gungl.
Overture—Raimond, ... Ambroise Thomas.

The President.—The association will please come to order. I have now the pleasure of introducing to the association the chairman of our

Reception Committee, Hon. G. W. Parker, president of the city council of St. Louis.

Mr. PARKER.—Ladies and Gentlemen: I do not propose to make you an address to-night. My duty is to introduce to you others for that purpose. I will say, however, that the people of St. Louis delight to honor their guests, and it is for the purpose of showing their appreciation of the great work in which you are engaged that they ask your presence here to-night. I have now the pleasure of introducing to you His Honor William L. Ewing, mayor of the city of St. Louis. [Applause.]

Address of Mayor Ewing. (See page 22.)

Waltz—Glücks-Stunden, ... Keler Bela.

Mr. PARKER.—I have the honor to introduce to you, Ladies and Gentlemen, His Excellency General Thomas J. Crittenden, governor of the great state of Missouri.

Address of Governor Crittenden. (See page 17.)

Serenade—Cornet Solo, ... Herforth.

Mr. PARKER.—It was expected at this point that Rev. Dr. Eliot, chancellor of Washington University, would address you to-night, but I regret to say that a serious illness prevents his being present. There is probably no person that takes a greater interest in the subjects for the consideration of which this convention is assembled than Rev. Dr. Eliot; but he does not entirely deprive us to-night of his address, for he has kindly sent his son, who will read to you what the doctor would have said if he had been here. I will introduce to you Mr. William G. Eliot, son of Dr. Eliot.

Mr. WILLIAM G. ELIOT.—My father wished me to express his very great regret at not being able to be present this evening. He had intended to be here up to within two or three hours ago, although at a very great risk to his health, but at the last moment he handed me his address, and requested me to read it.

Address of Dr. Eliot. (See page 25.)

Potpourri—Beggar Student, ... Mellickoer.

Mr. PARKER.—I have the pleasure of introducing to you Dr. Elisha H. Gregory, president of the state board of health of Missouri. [Applause.]

Dr. GREGORY.—Ladies and Gentlemen: I find my name in this programme, and I must say that it was put in without my authorization, and I believe that the length of the title attached to it will be longer than my speech. I am very glad that Governor Crittenden delivered such a long speech, because I think the association, perhaps, will be satisfied with a very short one from me.

Gentlemen of the American Public Health Association: As a representative member of the Missouri State Board of Health, it is my proud

privilege to tender you the hospitality of our state and city. Everything relating to sanitation must be of importance to the entire human family, and stand in the front rank of subjects, so related are they to the causes of disease. Now, I never think about causes of disease without a sense of humiliation; but I console myself with the reflection that we have accomplished so little in this direction because of the insuperable difficulties of the subject. I know that the ablest minds have engaged in inquiries of this kind from the earliest period of our history; and if I didn't reflect that it was the most difficult of all subjects, I would certainly conclude that intellect seems to be impotent in this particular direction. But until we know the causes of diseases, we cannot hope to prevent them. Prevention is the highest ideal of the sanitarist. Therefore, Gentlemen, we welcome you as philanthropists and scientists of no ordinary pretensions, and as votaries whose aim is so exalted that the end proposed will not, can not, be accomplished until science has reached its utmost limit.

Again, Gentlemen, I give you an assurance of a hearty welcome, coupled with the hope that your deliberations may exceed the most sanguine expectations of your society. I say, God speed the good work. [Applause.]

Gavotte Gemüthlichkeit, ... Bernstein.

Mr. PARKER.—The next thing in order will be the address of the president of the association, Medical Director Albert L. Gihon, U.S.N. [Applause.] (See page 1.)

The PRESIDENT.—Before I read my address, allow me to announce that the University club invites the members of the association to visit and use their club-house during the sessions. I have also a letter which I will read from the president of the National Conference of Charities.

Fest March, ... Strauss.

The association adjourned to meet to-morrow, October 15, at 9 o'clock A. M.

SECOND DAY.

WEDNESDAY, October 15, 1884.

MORNING SESSION.

The association reassembled at 9 o'clock, Dr. Albert L. Gihon, president, in the chair.

The PRESIDENT.—The first business in order is the customary announcement from the Committee of Arrangements.

This was made by Dr. George Homan, of St. Louis, secretary of the committee.

The PRESIDENT.—The secretary will now announce any communication from the Executive Committee.

Dr. IRVING A. WATSON, secretary, read a list of names, as recom-

mended for election, who were, on motion, unanimously elected members of the association.

The secretary read a communication from the secretary of the Fair Ground Association, F. J. Wade, Esq., inviting the members to visit the fair grounds in this city.

The president called on Dr. George Homan, of St. Louis, acting chairman of the Committee on Compulsory Vaccination, for the committee's report. Mr. Homan said the committee considered that the question was so fully reported on at the last annual meeting of the association that they had thought it unnecessary to submit a further report to this meeting.

A paper on the "Hygiene of Eyesight of School Children," by Stephen O. Richey, M. D., of Washington, D. C., was read by the president. (See page 51.)

The PRESIDENT.—Owing to the absence of Professor Sargent, Dr. Abbott, of Boston, Mass., will read the "Report of Committee on School Hygiene." (See "Report of Committees.")

Dr. ABBOTT.—In consequence of an unexpected attack of the sore throat, I shall be obliged to submit the paper upon which I have prepared myself, "The Water-Supply and Drainage of School-Houses," by title only.

The report of the Committee on School Hygiene was then read, and, on motion, adopted.

Mr. BROOKS.—I hope that that committee will be continued, the subject is so important.

The PRESIDENT.—I would suggest personally that the committee might be enlarged. We have a paper here by Prof. Hartwell, of Johns Hopkins University, on the same subject. It would be well to include in the committee other members who have investigated this matter, if the resolution to continue the committee shall contemplate an increased membership.

Mr. BROOKS.—I move that the committee on "School Hygiene" be continued, and increased to seven members.

The motion was adopted.

The PRESIDENT.—Dr. Abbott's paper on the "Water-Supply and Drainage of School-Houses," he submits by title, having a sore throat, not being able to read it.

Dr. RAYMOND.—Why can't it be read by somebody else? It is a very valuable one. It seems to me a paper written by Dr. Abbott, and so valuable, should n't be passed over.

The PRESIDENT.—Will you read it for Dr. Abbott?

Dr. RAYMOND.—I will, sir, with pleasure.

The PRESIDENT.—We will pass over Dr. Abbott's paper at present, but Dr. Raymond very kindly, at my suggestion, offers to read it. The next paper is on "Physical Training in American Colleges and Schools," by Prof. Edward M. Hartwell, M. D., of Johns Hopkins University. I do n't think Dr. Hartwell is here, but Dr. Beugless will, per-

haps, read it for him. We will pass that for a moment. Is Dr. Elder here?

A Member.—He is in the city, but not here.

The President.—Is Dr. Formento here? (No response.)

The President.—Will Dr. Beugless then read Dr. Munroe's paper on "Cotton-seed Oil as a Food"?

Dr. Beugless.—I have not had time to run my eye over this manuscript, and I should be glad if you would substitute something else until I can have time to do so.

The President.—Is Prof. Vaughan here? (No response.) I am sorry the members have not been punctual with their papers. We had difficulty in trying to include all the papers in the programme.

A Member.—Dr. Vaughan is in the city.

The President.—Yes, they are all here, I know. They are all in the city.

Dr. Beugless.—This manuscript appears to be legible, and rather than delay any longer, I will read it now. It reads as follows. (See page 236.)

The President.—The use of cotton-seed oil, of course, is a matter of importance, and should be discussed, but as the paper is read out of its natural order, I propose we revert now to the subject of school hygiene, and defer the consideration of foods until later in the morning. Has Dr. Lindsley, of Connecticut, arrived? (No response.) Dr. Formento will then read his paper on "School Hygiene." (See page 38.)

The President.—Is Dr. Elder here yet?

A Member.—Dr. Elder is here. I do n't believe he is in the room.

The President.—Dr. Hibberd, will you ascertain if he is outside?

Dr. Hibberd.—He seems to have disappeared. Your voice was heard all over the hall.

The President.—Yes. Dr. Elder, I know, is in the city. I have tried to set an example of promptness, for we have a very full programme, and if we are to read all the papers, others will have to manage to be on time.

I will take advantage of this interval to announce another invitation. I do it with some regret, because I am afraid we have had too many altogether. This is an invitation to the St. Louis club and University club. Tickets for admission to these clubs are in the treasurer's office.

Is Dr. Elder here?

Dr. Elder.—Yes, sir.

The President.—Ah! then we will hear Dr. Elder's paper, and after that have a discussion on the subject of "School Hygiene."

Here is still another invitation. "At a meeting of the board of president and directors of St. Louis public schools, held last evening, the following resolution was unanimously adopted:

"*Resolved*, That as there is now in session in this city a very honorable body, The National Health Association, this board extends a cordial invitation to the members and

friends of the association to visit the public schools of the city and the public school library.

"I have the honor to be your obedient servant,

MILTON H. WASH, *Secretary*."

We will now listen to a paper on "The Sanitary Survey of the School-Houses of Indiana," by E. S. Elder, M. D., secretary of the state board of health of Indiana. (See page 57.)

The PRESIDENT.—We have now finished all the papers on School Hygiene except that of Prof. Hartwell's, which has miscarried in some way. I will therefore simply read it by its title, and we will proceed at once to the discussion of the subject of School Hygiene. Prof. Hartwell's paper is a very valuable one, and embodies some of the investigations that he has been making for the Johns Hopkins University. (See page 27.) The subject of School Hygiene is now open for discussion.

Dr. RAYMOND, of Brooklyn.—It must be exceedingly gratifying to the members of the association to find that the Executive Committee have given so much time to a subject of so much importance, and the embarrassment which any one must feel, I think, in discussing this paper, is one which I feel when so many topics have been suggested for discussion. One of the great difficulties which have always been met with in our large cities is, I think, due to the fact that medical men have not hitherto been represented in our boards of education. Some years ago, in the city of Brooklyn, for the first time, a medical man was put on the board, and a Committee of Hygiene was appointed for the first time in the city of Brooklyn. Our distinguished Dr. Bell was placed upon that committee. I remember the difficulties he met with in the outset. In fact, I think he was almost the only one on the board of some forty members who endeavored to impress upon the board of education the necessity for sanitary improvements in the public schools. But, with his indomitable energy, continuing the work, pressing on day after day, week after week, he has accomplished a great deal. So at the present day, although there is very much to be desired, yet great improvements have been made. Among the changes which were recommended then by him was the necessity for increasing the floor space and air space, and an improvement in heating. I well remember some investigations in those schools, in which it was found that while in some portions of the room the temperature registered 60°, at another, about fifteen or twenty feet distant, where the stove was, the thermometer registered over 90°. So we had all these different variations, the temperature running from 60° to 90°.

While attention has been drawn largely, as it is proper, to the public schools, it seems to me that the question of our private schools has been very much neglected. It is true that a great majority of our children attend the public schools, but yet the number that attend the private schools is to be numbered by the thousand, and in some cities by the hundreds of thousands. Those who know, know the fact, that the private school-houses are built without any reference to school uses. They

are ordinary dwelling-houses, which have been turned into schools by some impecunious individual desiring to make a living, and, being unsuccessful in other walks of life, starts a school. First, he has one or two children from among his intimate friends. This number is increased. No matter how small the room may be, yet the number of scholars is only limited by the number of applicants. I have yet to learn of any private school where any individual applying has ever been refused admission; and we find in the schools all the defects which have been characterized in that paper—windows without any reference whatsoever to the purposes of the school children sitting near the windows, with the light directly in their faces, the blackboard placed as has already been described, and all the elements which are necessary, and which have been so properly insisted upon in this paper, absolutely wanting. Another difficulty which is always met with in these private schools is the fact that they are usually occupied by the family. The consequence is, as has over and over again been established by our experience in Brooklyn, that contagious disease has broken out in the family, and there has been a disposition on the part of the family to conceal it, because they knew that as soon as it became known the school would be closed. Persons with scarlet fever and other diseases have been allowed to remain in a private school for several days before their presence became known. This has also occurred in the public schools, where the building was occupied by the janitor and his family. So it should be insisted upon that no family should be permitted to live in a public or private school building. Leaving out of the question the inconvenience resulting from the cooking by the family,—and every one knows the difficulty of excluding from the dwelling-rooms the odors from the kitchen,—leaving all those insignificant points out of the question, yet the danger from the spreading of disease is very great. It is, I know, a very difficult task to exclude contagious diseases from schools. We have required in Brooklyn, as is the case in many other cities, that contagious diseases be reported to the health department. We have the city divided into districts. We have a map which gives an outline of the sanitary districts, with the name and address of each sanitary inspector thereon. By an ordinance of the city, it is required that every case of contagious disease be reported to the district sanitary inspector. It becomes his duty to proceed to the house where the disease is, ascertain the name of the child, and send to the school the name of the child and address, together with an order to exclude that child from the school. Nor can any such child return to school until it obtains permission from this same district sanitary inspector. We found, before this later requirement was made, that physicians would send certificates, and the teachers admit pupils back again upon the physician's certificates; and it is a sad thing to say, those physicians would give certificates without investigating at all. It was found, case after case, that they would admit children when the process of desquamation was going on. So it is the requirement of Brooklyn that no one shall go back to the school without a certificate of

the health officer or the inspector. It is his duty to see that everything in the way of fumigation has been done; also, to see that the child has passed a stage in which he might communicate disease.

Hon. Erastus Brooks, of New York.—There are some things that must be taken as admitted by the intelligent representatives of the health board, and I think by the great body of intelligent people whom we represent here, and it ought to be so plain that there should be no question about the truth of the statement, to wit, that sanitary education among the children of the state is just as important as their intellectual education, and practically of a great deal more importance. Now, Mr. President, there are in this country, according to the census of 1880, 7,000,000 of children attending the common schools of the thirty-eight states and territories,—7,000,000 of children growing into manhood and womanhood, to become the future fathers and mothers, brothers and sisters, of this republic; and there are 224,000 teachers in these respective schools. That large number does not represent the private schools. There are in my own state 11,000 school-districts and 11,000 schools, and necessarily a good many more teachers than there are schools, in that commonwealth. When these facts are presented to the public, or the United States at large, for a single state in the Union, I am sure no subject could be presented of more practical importance in regard to the health and comfort of the rising generation. We have had a sad picture of the schools in the state of Indiana, yet, as my friend says, I do n't know that it is relatively worse there than it is in other states of the Union. But I am happy to say, for the state of New York, that the state board of health, although only four years old, among its first duties appointed a competent school inspector to visit, so far as practicable, the several schools of the state, and to report to the state board of health; and the state board of health has reported to the state legislature what was the condition of those schools, and very many of them there are as bad as they are in the state of Indiana. But the work of the state board of health has become so interesting to the school trustees in the several towns in the state, as to enlist their sympathy and intelligent action for the removal of existing evils. Now, sir, with all this bad picture there is another side to it. On the whole, there has been none of more importance in any other department, unless it may be in the treatment of the prisoners in the jails of the country, than in the common schools of the state. When I was a young man, in common with so many of the New England states where I was born, the practice in regard to school teachers, when they presented themselves for examination, was a process something like this (it was the experience of my brother, and partially my own experience), to put the schoolmaster literally up at auction: There was a bid for him. How much will you board the schoolmaster for for the ensuing ninety days, or one hundred and twenty days, in which he is called upon to teach school? The head master of the school-district would make his bid of a dollar and a half a week for board, and then there would be competition, and somebody would bid down to a dollar. In the case of my brother, he was

bid off at ninety-two cents a week for one hundred and seventy days. Well, it was not a bad kind of a bargain, because those who bid desired the company of the school-master, and when they could have the minister of the town or the minister of the village, and the school-master, together, they found a sort of compensation in the return which they received from the company of the school-master and the minister. Well, there was another practice, which was my own experience, in a place in Massachusetts on the Merrimack, where there was what is called a grammar school, and my experience in regard to that was this: The public required us to teach the boys five hours a day, and the girls two hours a day,—and I hope I may say, without any reflection upon the sex, that that two hours caused me more trouble than the other five hours; for I know the proper remedy for bad boys, but I have never yet discovered the proper remedy for bad girls. But as this is a sanitary question, I wish merely to enlarge upon the subject which I have set out upon. That is of vast importance. Now, if you will think for a moment that there are 7,000,000 children being educated, and contemplate for a second their future lives, you will see how vastly important it is that in regard to health it should be the first thing considered.

As a member of the state board of health, some two or three years ago I visited one of the schools on the Hudson river, in the village of Peekskill, one of the largest in the city, and it was a perfect abomination in regard to some of the evils which have been set forth in the last paper read. We were persistent, and we were successful in that persistence, that that school-house should be burned down. The school building had existed for fifty years. It was not fit for brutes to inhabit, much less for children to live in for a portion of their days. What is requisite is for the members of the state board of health to insist upon the removal of all such obstructions to health and comfort, and to hold such communications with the local boards of health, and such school commissioners and school trustees, as will result in the education of that class of people, and in the removal of these obstructions. Now, there is another great evil, Mr. President. Our school commissioners, as a rule, and our school trustees, are politicians, the stronger party often electing the worst men. If possible, by some statute or some other means, that evil ought to be remedied. There ought not to be any politics in school commissioners, in school trustees, in that class of officers where all are interested alike in promoting the common good. (Applause.)

Dr. Pinckney Thompson, of Henderson, Ky.—I am interested somewhat in this paper, although I did n't hear all the paper read. Whilst I endorse all my friend said, and probably would endorse more if he had time to say it, there are some other things that seem to me, as a school trustee, a practitioner of medicine, and a member of the state board of health, more appalling than it all. You have just referred to the immense number of girls and boys that are being murdered, according to my notion, or, rather, in other words, disqualified for the very things God created them for: our public schools, in my judgment, in a large measure are the cause.

One of the faults, sir, of nine school boards out of ten that I have had any association with, either in the city or country, and especially in the large cities, is the building of what they term handsome school-houses. I can readily imagine, in a city of this size, or any other larger or smaller city, that sometimes space is a very important matter, and you have not got the ground space: you are compelled to seek in elevation what you lack in ground space. I have never been in a school-house yet, either in New York or in Philadelphia, in Indiana or in Kentucky, except it was a country school-house, that had the requisite air space for the number of pupils that were crowded into it; and I will venture to say that it is what you have all observed. If there is any set of men in this country that it seems to me do not understand their profession, it is the architects. I have never been in a school-house that was ventilated, in my judgment, as it should be. In a large majority of instances the rooms are 20 by 30 feet; sometimes I have seen them 22 by 30, with probably a 12- or 15-foot ceiling, and fifty children crowded into it. Now these tender creatures are crowded together right there, when they need fresh air for their physical as well as for their mental development. They are crowded together, and this is sanctioned by their parents. I am a man, sir: if I live for anything in this world, it is for my children; and I cannot tolerate for a minute, never did tolerate, and never will, their being crowded into these institutions under such circumstances. Take it in Kentucky, and you won't find the pale-faced and little weakly girls about our country schools; and I suppose it is the case everywhere else, for two very important reasons: One is, they have got good air; and another one is, that the girls are not murdered by climbing four or five flights of steps five or six times a day. I think it is the duty of the sanitarist, sir, and we are attempting it in Kentucky, to impress on the people, with all the power we have in us, the recognition of these two evils. I have seen a case in my own town where one third of the girls in that school, before it ended, were compelled to quit in consequence of the stairway. It is an abomination of the nation. I do n't think it is any worse there than anywhere else, and probably about the same. I think it is one of the greatest evils, in fact, if not the chief evil, in school-houses. These hotel school-houses will not hurt the boys; but I can show you hundreds of women over this whole country, educated in these schools, having tramped up and down these stairs, that are now delicate women, who, if they had been educated in one of those old-fashioned school-houses where they had nothing but logs to make them of, would have been healthy and strong women to-day. That is a point I want to bring before this association. (Applause.)

Dr. R. Harvey Reed, of Mansfield, Ohio.—Mr. President, the subject of school hygiene is certainly one of vast importance, and I did not intend to say a word in regard to it. I listened to the papers with intense interest; but I cannot refrain from saying a few words brought to my mind by our friend here from New York. When he spoke of the school-master's being put up at auction, I could remember very well when I was a

school-teacher: although we were not put up at auction for our board, we were put up at auction for our salary. I remember very well when I taught my first term of school. When I went to the first district and put in my bid, I was under-bid. I went to the next district and put in my bid, and I was then under-bid. I went to the third district to put in my bid, and I hesitated a minute and said to the school board, "What will you give me? I must teach school. It is the only way I can get my education; I must teach school before I can go to school. What will you give me?" "Why, we will give you $20 a month, and you board yourself." "Very well, I will take it." I was obliged to walk four miles every morning and evening, and for my board I attended to the stock on the farm. I couldn't get board anywhere nearer than that. Nobody wanted me. I taught my school, however.

Now let us go to the school and see what kind of a house I had to teach in. The school-house was in one respect good enough. It was out in the woods. This was in the summer-time, and the house was right in the midst of a large timber land, without any improvements about it at all. The school-house could not be ventilated, because, if you raised the windows, the scholars were eaten up by the mosquitoes. We had to choose the least of two evils. We had to give them exercise at noon, and a recess for their general health. The school board never came to see after the interests of the school. They expected me to go ahead and teach the scholars. In addition to this, we had to have spelling-schools at night, and then the people from the country around crowded into the school-house. The house had to be shut up tight, and there we were for three or four hours in this terrible atmosphere. This was a part of the work we were obliged to do for $20 a month. Now, Mr. Chairman, I bring this up simply as a sample of schools in Ohio to-day. This was not many years ago. A few years ago I was teaching in an old school-house broken in at the gable end, a miserable low ceiling, poor windows, and we were obliged to get the water for that school-house from a farm-yard. Near that well was a pool, and in that pool there were continually a lot of geese and ducks; the horses and cattle tramped around this well, making it muddy all around it. There was the place where the scholars in that school had to get the water they drank. They carried it nearly half a mile. The district paid from $20 to $25 a month for their school-teacher. A little later on I was employed in a school of a little higher grade. The scholars were crowded together three in a seat; the ventilation was poor—no way to ventilate except by the windows; and if a window was raised, the fellow sitting next to it growled because he felt cold; and we were expected to teach those scholars just as well as you would these here in the city. Now, what was the result in that school? We had no government to protect us from disease, and the result was, the mumps broke out, and I was the first fellow to get them. After that the entire school got them. The result was, it broke up the school. There was a preventable disease, but the teachers, scholars, and all came down with it. I simply bring these

facts up in personal history. I could not keep still. I bring them up to show that we have reason in Ohio to ask our people to give us a health board. We have been working and praying for it, and I hope the good Lord will spare our lives long enough to see it.

The PRESIDENT (Dr. Reeves, second Vice-President, in the chair).—I only rise to emphasize the statement of Dr. Thompson, that if there is any one thing in school hygiene requiring attention, it is this subject of ventilation. Now, food, of course, is an important matter. The stomach is an organ, fortunately, into which you can put a great deal of bad food, and still it will get along; but the two essentials of health, particularly during childhood, are fresh air and sunshine. I have visited many schools, and I assure you I have never yet entered one in which I did not recognize bad air. I make it a point to go in an hour after the school has commenced, and I never yet have been in any school in any city where I did not discover the morbid odor from over-crowding. The teachers or superintendents will deny that the air is foul, because they do not recognize it. They become accustomed to it, they live amidst it, and they do not perceive it themselves. I have never been a teacher, but I was five years the senior medical officer at the United States Naval Academy at Annapolis, and I discovered this same faulty ventilation there. I partially rectified it by a simple procedure, which is so simple I have never been able to induce any other body or school to introduce it. It is nothing but a piece of a board six inches wide screwed under the bottom of the lower sash, compelling an over-lapping of the two sashes. The air is injected into the room over the heads of the scholars, and it is not felt. At Annapolis we left those boards unpainted, that their clandestine removal might be easily detected from outside. We had them in every sleeping-room. That simple procedure was sufficient to supply those rooms with fresh air. I sympathized with Dr. Thompson when he was speaking of the unsanitary conditions to which children are subjected. When I was at Portsmouth, N. H., I had a little girl who went to school. When she left there she was robust, rosy, and strong, and could whip any boy of her age. I went to Annapolis, and I sent her to school, and she hadn't been there more than a few days when she came home with her head aching, her face flushed; and when I inquired what was the matter, I found she was in a room which contained a red-hot stove, and all the windows were down. No amount of persuasion could induce that teacher to ventilate that room. She was a delicate woman, and insisted she was chilly; there were sickly children there, and they were chilly; and the few robust children had to suffer in consequence. It was not long before my child got sickly, and I took her away. There was no better school to which I could send her, so I did not send her to school at all. There was another point to which Dr. Elder referred in the paper of Dr. Richey, and that was with reference to this matter of eyesight. There is a good deal said about bad print in the school-room, but as much injury is done by bad print at home. Schools are not schools for instruction: they are simply places

for recitation. I do not know that you have the same experience that we have at Washington, where we are expected to do all the teaching at home. I have to do the instructing, and my boy's studies naturally interfere with the family, or he has to go off to another room, working away at night by the gas-light, in order to be able to compete with the other scholars. The type in all the books is wretched. We ought to have, in addition to proper ventilation in the schools, an absolute suspension of all study at home, properly printed school-books, limited school hours, and the entire instruction done within the school building. [Applause.]

Dr. P. H. Bryce, Secretary of the Provincial Board of Health, of Toronto, Canada.—Mr. President and Gentlemen, I feel that I should add my part to this discussion, and I will do so by simply presenting a few statistics, which I have been fortunate enough to obtain from one of our larger cities, which will illustrate perfectly the points to which Dr. Gihon and others have referred. In the city of Hamilton there are 5,000 public school children, and with our well regulated system these children attend very regularly. In the year 1882 a register was kept of the children who absented themselves, and the reason given in almost every case was that of sickness. You will remember there were 5,000 children. In the month of January some 600 children were reported absent from school. During the next month a similar state of affairs existed, slightly more in March, and a few less in April; and in the month of May, when the windows could be opened, and the stove was out, the number reported sick fell suddenly to 50 per cent. of its previous number. In the month of June, when the children were supposed to be attending regularly in consequence of promotion and examination, the number was yet lower. Now, starting with September, after the holidays, the number of those reported sick was very small. In October, when the fires began, the number ran up; and in December it crept up to the highest point in the whole year. You will notice these figures—out of 5,000, something more than one child sick for every ten scholars. In one school the average air space of the floor was about eight feet. It ran down in one school to two and a half-feet of floor space, and the room was about fourteen feet high; but the average was about eight or ten, assuming the room to be about fifteen feet high. So any one can see how frequently the air ought to be changed in order to get the proper quantity of fresh air. One other point to illustrate this, to show what good ventilation means and good sanitary arrangement, was seen in a school, one of the largest and one of the newest. The returns show that in this school, for the same year, the number of children reported sick was only 25 per cent. of that in any of the other schools. I was informed further, from the reports, that of all the cases of sickness reported, 50 per cent. were due to colds and headache. I need not refer here further to what this means, in regard to bad air and in regard to air of unequal temperature. All of us know that perfectly well. But I have simply illustrated a case in Hamilton, where one good school has

in one year reduced the number of sick children reported to one quarter of what it was in the other schools.

Dr. BELL, of New York city.—I did not expect to say a single word on this subject, until after the president spoke of his manner of ventilating school-houses. It is a good way to let in fresh air, but it makes no provision for getting rid of that which smells so strong, and which is so foul, not only with regard to school-houses, but with poor-houses, almshouses, or wherever there are old men, or children, gathered together. We all know that in these cold climates most of the school-houses are heated by stoves. It is the easiest thing in the world to get cold air into a room, but that does not ventilate it. Now, we wish to get rid of the foul air. It has been more than twenty years since I visited one of the poorest patients, in some respects, that I ever attended. She was down with the diphtheria, and had three children. The stove-pipe consisted of a sheet-iron pipe, about three feet long, going into the chimney-flue. There was no fire-board. There was a hole to fit this pipe into. To save fuel, she had chinked all around her windows. What fresh air she got, at times, came through the necessity of her going in and out. I sent for a stove man, and I had a ventilating flue put around that stove-pipe. It consisted of making another pipe two inches greater in diameter than the stove-pipe, fixing it so it would press off from the stove-pipe up near the stove and the collar, with slots in the tin. The pipe went through into the chimney. In that way I produced an exhaust draught around the stove-pipe, the heat of which made a splendid draught to let out the foul air. This year I have, in the infant asylum with which I am connected in New York, where the conditions were as bad as the average of the public school, made a change for the purpose of ventilation. We put in these open stoves, which are excellent. The pipes (most of them) ascend directly, and go through the roof. Some of them, however, go into the flues at the side. Around each one of these smoke-pipes we have placed ventilator shafts. They come down to within six or eight inches of the floor, and they are "slattered" out so that they stand on legs, as it were, near the floor. The collar that I speak of is also fixed to take out any foul air at the ceiling. Now, these contrivances are automatic. They cannot be changed by the nurse or by the teachers. We might also almost say they are automatic in their good effects. The colder it is, the hotter the fire you make. The tighter you close your windows and doors, so much the greater the necessity for letting out the exhalations of the inmates, and so much greater is the draught from the increased heat of the foul atmosphere of the room. Now, the window contrivance is an excellent one; but you must have something with which to get rid of the foul air, because that will not ventilate. Moreover, the place of entry between the sashes is for many reasons the best that can be adopted. It is a common practice in school-houses, owing to the condition of some of the boards of education to which my friend from New York alluded,—they are not always the best men, they are not always educated men, they know very little about the

properties of the atmosphere, and they love to dwell upon the subject of carbonic gas,—it is a common practice, I say, for them to make scuttle-holes, as you would call them in the navy, all around the room for the carbonic acid to run out. Now, it is too commonly the case that the cold air comes in, instead of the foul air going out, at these holes. The effect of the cold air coming in is to give the children a cold. It makes the floor cold. It stirs up the dust all over the room, and it makes the air foul in every point of view.

Rev. Dr. JACOKES, of Michigan.—What we want to get at is some practical method of accomplishing the purpose of getting good fresh air into the house. About fifty years ago I began studying this question of having pure air, and I never have lived in a house, or occupied a public hall or church, without having pure air, and enough of it. It is a simple thing to get, and costs but little. The difficulty with us is, we want to be so scientific that we lose our common-sense when we want to make provision to cure these difficulties. Now, I will go into any of these school-houses in cold weather, and for from ten shillings to twenty shillings I will make such provision that you will have good warm air in the house at one third less cost, and all the ventilation you want. It costs from ten to twenty shillings, and the most I ever knew it to cost was about $10. Now, the principle of getting warm air, when you are heating by a stove, is to bring the out-door air against the heated surface. If it is a stove, put a jacket over it, and have it open in the front; and then you want to carry your foul air from the floor, and that is the only way you can get it out. Now, I have heard a learned discussion here about equalizing the heat. It is the simplest thing in the world. You take it from the floor into a hot flue, and you take all the foul air out. Now, it is just this simple thing, simple as possible. You bring the out-door air to any heated surface, and you want your fires just hot enough to make the air warm, and that is all. If you take it from the floor, the foul air in a heated flue, you will have nothing left but warm and fresh air constantly. In the summer time, Mr. President, the method is the very best method possible, if you want to get the pure air in and the foul air out. Now, I will just repeat: Take your out-door air any way you please, I care not how, against a heated surface, put a jacket around your stove, and you can turn the foul air from the floor, not two inches above, nor one inch above, nor half an inch above, but from the very floor, in a heated room, and your air is pure from the ceiling to the floor. [Applause.]

Mr. ROBERT MOORE, C. E., of St. Louis, Mo.—I understand that the National Bureau of Education at Washington has been making investigations into this subject which we would be very glad to hear. A gentleman of that board, whom I should like to have address this meeting, will explain to us what they have done—Mr. L. A. Smith.

Mr. SMITH, of Washington, D. C.—Mr. President and Gentlemen: I hardly have any paper to present, and had no thoughts of presenting anything when I came into the hall this morning, but I found the discus-

sion was upon a subject which has been very near the heart of the commissioner of education, Gen. Eaton; and so I venture to state a few points which he gave me, or spoke to me about, before I came away from the Bureau on Monday. He himself expected to be here, until Monday noon, and found at that late hour it would be impossible for him to leave the city in time to be present at this meeting. We have opportunities, through the immense number of correspondents that our office has, to find out the exact condition, you might say, of the buildings which are used for schools, and the procedure common to those buildings, and all the defects and deficiencies which arise in this matter of school hygiene. With this in view, General Eaton has intrusted to one of the employés of the Bureau, Prof. Packard, the collection of information, and he has made up a series of inquiries which will be sent all over the country, which embrace those questions, and which will show the condition of school hygiene. Some suggestions are given in it which will enable the people to improve upon their buildings, and to do a great deal of thinking in regard to this matter, and we are in hopes, in this way, of presenting the facts in this case with regard to the defects in school hygiene. Prof. Packard inquires with regard to the building, its location with respect to other buildings, dimensions of the whole building, and the rooms. Then there are questions in regard to the sunlight, and questions with regard to the outbuildings. Prof. Packard inquires with regard to the room, to the length of the room, the cubic feet, the direction in which the rooms face, the lighting of the room and the flues of different kinds, the method of heating, and all those questions which affect the matter directly. Then he is requested to examine into the climate of the room, which includes heat, of course, and then give some simple instructions. I suppose the percentage of carbonic acid will be easily obtained by Prof. Packard's method. I understand that the amount of carbonic acid in a room, over and above the normal amount, is, to a certain extent, injurious in a school-room at a time after school has been commenced. I call your attention to this, and I hope if any of you are so situated with regard to the schools that you can aid the teachers in replying to those inquiries you will do so; and you will also encourage the officers, thus opening the way for a presentation to the teachers of the country, and to those who are in charge of the schools, the remedies which may be applied to the building, and for the purpose of having pure air and ventilation, and avoiding all those sources which are so common to all.

Dr. Conn, of Concord, N. H.—I have but a word to add, and no theory to advance. It seems to me that most of the speakers present are physicians, and a great many of them, from the remarks which they have made, I judge are in some way connected with school boards. It seems to me strange that all who are connected with, and in a certain manner responsible for, the manner in which our schools are conducted, have forgotten the manner in which they received their own education, especially their professional education. They seem to have for-

gotten that oral teaching is the best way to reach the greatest number of pupils. If we could have less sessions of so-called study, and have our teachers teach orally and from the blackboard, we should have less ill-health among the little ones who go to school. They would progress faster, would stand more erect, would be more happy, and their health would be preserved. I was glad to hear our president speak of the simple way of ventilating a school-room, or any other room, for that matter. Some have spoken as though, in the winter time, that would not suffice, but they fail to remember that for every cubic inch of air introduced into a room, the same number of cubic inches must go out. It is just as impossible to bring a cubic inch of fresh air into a room without removing one, as it would be to put an ounce of fluid into a full vessel without first removing the same amount. This is the first and only principle of ventilation: it implies a change. (Applause.)

Dr. BAILEY, of Louisville, Ky.—Only one or two points in connection with this subject have not been alluded to. It seems to be confined largely to the question of heat and ventilation. It seems to me we need to impress upon the teachers that they stand for the time being in the relation of the parents to the child. There are so many little things to add to the comforts of the child while in the school-room, besides simply how much fire might be in the stove, or how wide the window might be opened, that we ought to impress on the teachers to see that the little things are attended to; that a child be not allowed to go through the mud and rain, and sit for hours, it may be, with wet feet. Nothing of this kind has been alluded to. What is more common than that particular rules of the school require the child to maintain its place wherever it may be in the room, the teacher taking no care to move the one with the wet feet up to the stove and allow them to dry, or to change their positions according to the needs in the particular case. I think they ought not to be discouraged in the cause of sanitation in schools because we are not accomplishing very much. We are not accomplishing it very rapidly elsewhere, I believe, and yet we are making progress; consequently I think we may take courage, because it is said, and you have all heard the remark, that "Rome was not built in a day;" neither can you accomplish as great a work as this at once. We must educate, we must make public sentiment, we must go before school boards and have these principles taught, this question of hygiene being a part of a regular curriculum, a regular course in the schools. It has been my privilege to go before the teachers' association and have a discussion upon sanitary education. The necessity for teaching this, even in the profession which I have the honor to belong to,—the medical profession,—is great. We find medical men, even, that are not observing the rules of hygiene. Only a little while ago, before I came away from home, I was called to administer to a physician's child with a preventable disease. Of course I made inquiry as to the surroundings. "Doctor, where is your closet situated?" He opened, from a very pleasant apartment, a door into a bath-room and closet. "Doctor, what is the condition of this?"

"Oh! it is admirable. There are four traps in that thing." I did not wonder that they had been caught.

Allow me to say, for the comfort of Mr. Brooks, that in the paper that we had presented yesterday, after looking it over, I find that the plumber is only allotted thirty-five years and a half of life. I believe that is the lowest in the scale. For his consolation I will say that thirty-five years and a half are allotted to him, and if we can get them to set their own traps for themselves perhaps we can make it lower than that. A point I want to press is this: As we want to be educated in this matter, we must quietly but persistently work among the people until we imbue them with the necessity of right living, beginning at the ground, so that the next generation will accomplish much more than we will be able to do.

Dr. Riley, of Indiana.—The question does not turn upon how we should send our children to school, I take it, nor to whom we should send them. There is very frequently, in connection with the desire to educate the child, a wish to get the little thing off to save trouble. I take this position, that the American people have gotten to that point where they think childhood should be ushered into a school-room from the time it begins to talk. The neighbor's child comes in, sir, and begins to speak of its surroundings at home, of its amusements, and of the attractiveness of the school-master or school-mistress. My own child comes home and says, "Pa, I want to go to school too"—four, five, six, or seven years of age, as the case may be; and to gratify that child, shall I comparatively sacrifice it? No. Why? Because the child is not in a situation to be thrown away from the influence of the parents and home. It is not in a situation to receive the vicious influences by contact with those who have not the proper moral surroundings. When the child reaches the age of ten years, with the proper surroundings at home, with the proper moral and social teachings, it is then time to send it to the place of learning. The question of dollars and cents is not always involved in the school-master or the school-mistress; but I find, throughout this broad land of ours, men and women whose hearts are imbued, not only with philanthropy, but with an absolute love of the individuals themselves that are thrown upon their resources as teachers, being competent, who enter, with all the vivacity possible for any human being to have, into every feeling and impulse of that child. By those feelings, imbued into that child, the child is led, not driven, as is often the case, to a position where the mind itself absorbs, almost like a piece of sponge, everything that is in the shape of information.

Upon the subject of school-houses, in connection with ventilation, I have been to see a good many in the local districts. It is a known fact that the human lung, under all sorts of circumstances, in different individuals, is one of the best barometers in the world. By way of illustration, take fifty or any other given number of individuals, and put them in a room. The atmosphere to some, sir, is oppressive; to others it is too cold; to others it is too hot. Why is that? That is owing to phys-

ical peculiarities. When it comes to ventilation, sir, your remarks upon the subject impressed me with this fact, that it was a capital idea for general draught; but an individual who is predisposed to bronchitis, or to any throat or lung trouble, within the radius of that ventilation, will feel the effects of it, and the probabilities are you will hear over the house coughing that you have not heard before. The poisonous element in the atmosphere, with the exhalations from the lungs of carbonic acid gas, rises to the ceiling. By a continuation of the exhalations, it finally reaches the body. After reaching the ceiling, it gradually comes down. Then what are you going to do with all this bad atmosphere below? I have not seen, sir, in all the residences I have been in, North, South, East, or West,—I don't know, sir, where there is a building that is properly ventilated. You may say this hall is well ventilated. It is under peculiar circumstances. It is surrounded by windows. Suppose you should heat it in excessively cold weather, the thermometer down to twenty degrees below zero: would you throw open these windows? No, sir. Let the ventilation come from above, where the poisonous gas goes out; then with the rise of the atmosphere below, with the least effort on the atmosphere below it, it all goes out above. I think you will agree with me when you come to the architectural designs as to sanitary buildings, and the people should have that in view when they go to build elegant houses.

Dr. Devron, of New Orleans, La.—A great deal of what I would have said has been said by other members who have preceded me. But there is one cause of the over-crowding in the public schools, especially in large cities, that I have not heard alluded to. It is the desire of parents to get rid of their young children, who send them to school when they are not fit to be taught. They transform the school-ma'am into a nurse. I have often in my visits to schools found children there who require a nurse and not a teacher. There is no way of preventing it, except we condemn the parent who does it. The rich are guilty of this. They wish to get rid of the noise of the little ones. Those who do it should be treated with contempt—should be punished, and made to hire nurses for their children. The other parties who do it are provided in Europe by what are called public cradles, established by the late emperor of France. A woman may deposit her child there, and it will be taken care of—fed, cleaned if necessary—free of charge. When such an establishment shall exist, and when the rich shall be made to keep their children at home instead of crowding the schools when the children are not old enough to be taught, you shall have done a good work.

Another question is the management of the school funds. In many places the school buildings are built from revenue trust funds, which from time to time accumulate in sufficient amounts to build a school. The trustees very often are ignorant of the requirements of a school, and only study the problem, How shall we spend that money? And very often a magnificent building is placed where there is no necessity for it, because the money has to be spent. They build houses for accommoda-

tions for three times the number of pupils that attend the school, or will attend for twenty-five years to come, as was the case in New Orleans lately. They built a school-house costing over $50,000, which cannot be filled in twenty-five years to come. The trouble has been the desire of the board of trustees, maybe four in number, to spend the money. Another cause of trouble is the creation and formation of badly ventilated school-houses. The school board should consist of representative persons. They need not all be men of education. There should be a majority of them of liberal education to be able to examine the teachers, and be satisfied as to their qualifications. There should be also among them a sanitarian. By a proper combination of the educated, of the working-men, of the sanitarian, you would obtain a body of men who would tell you what they require for the children, and who would not place their children in houses of punishment, but of recreation and education.

Crosby Gray, Esq., of Pittsburgh, Penn.—Mr. President, I thought I would say nothing on this question, but it has been so ably discussed that I feel that it is the duty of almost every member of this body to give his sanction to it, at least. Almost every point in the question has been discussed, in my mind, with the exception of one, and that is, the inequality of the different school governments in the different states. Now, many of the states have state boards of health, and all the states have some method of reaching the same results. But the school governments, and the governments in the different states, are so diversified that no sanitary measure will equally apply to all; and if our leaders in educational matters will assemble in one body, and adopt some measure with reference to school government and these sanitary matters, it would be executed. In western Pennsylvania, where I reside, our schools are governed by local boards. It depends entirely upon how the politicians divide the school-districts in order to entitle the aspirants to the positions. Our school buildings are not in a good condition, and do not compare favorably with my idea of sanitary schools. We have some very good schools. We have some very high buildings, for which I express my regrets. We have some elevators. A girl told me, the other day, in her building an elevator had been placed. I asked her if she went up on that elevator. She said no; that was put up for the teachers. I don't know whether they intend to put up elevators for all the teachers or not. Our supply of air is very good in many schools, but in some of the others it is very bad. The buildings are surrounded with very small lots. They occupy entirely too little space; and I think one of the great steps, one of the most beneficial steps, we could take would be for our school officials—and I understand many of them are here to-day—to take home with them this question, and seek some method by which to bring about a unity of school government in the different states, and these sanitary measures can be applied.

Dr. Hibberd, of Richmond, Indiana.—Mr. President, there have been, as other gentlemen have said, a number of points here that I have had in my mind; and in regard to ventilation, I only want to reinforce and

emphasize the idea that as you get bad air out of the school-room or a tenement house, you must get good air in; or the reverse—before you can get good air in, you must get the bad air out, the idea being that dilution and diffusion are the grand methods in nature to make sanitary school-rooms and sanitary tenement-houses, and that this must be done by automatic machinery, not trusting to any supervision of the inmates of the house. It has been very well explained here just how this may be done; and if we keep that idea firmly and fully in our minds, the method of its application is not very difficult. Now, there is one other thing that I would like to say, and I am not sure that I have a correct idea upon it. I think I have a correct idea in this far, that it is never good policy to complain of a thing and ask for its correction until we know that it is absolutely wrong. In the sanitary survey of the school-houses of Indiana, so ably presented here by the secretary of the state board of health, in a number of instances in his reports it was stated that the school-houses were in close proximity to a cemetery. Is that really any objection? I know it is a popular idea spread as wide as the civilized world almost, that graveyards contaminate the earth, and of necessity the water in the earth in their immediate neighborhood. Is there any sufficient ground for the maintenance of that idea? You bury a man in a cemetery who weighs one hundred and fifty pounds, and for the decomposition of that body it will take one, two, three, four, five, or ten years, and maybe at the end of a score of years he has become crystalized or "stonified." What do you call it? He has not gone into decomposition at all. But suppose he does: suppose it takes one, two, or three years for decomposition to go on: has it not been shown by competent authority that the earth will take care of organic matter to a greater extent and better than yourselves? Has it not been shown here just how much organic matter will be taken care of by the different kinds of earth to which it may be presented? And, moreover, the hundred and fifty pounds of man who is buried in that soil, and is to be disposed of in two, or three, or five years, as the case may be, has for every twelve months of his existence for years before been the author of an equal amount, one hundred and fifty pounds, of excrementitious matter that must be taken care of somehow. He eats his own weight of material every month. The waste, therefore, in one year corresponds to the weight of the body. It is scattered about in the one case; it is concentrated in the other. But, as I said, Mr. President, I don't know that my views on this are correct, but I am apprehensive that we have an unusual and unwarranted distrust of the soil and the water in the neighborhood of cemeteries; and if there is any evidence extant now which goes to show that there is reason for it, I am not acquainted with it.

The PRESIDENT.—Gentlemen, it is one o'clock, the hour that we had set for closing the discussion of school hygiene. If you will allow me, without leaving the chair, before we proceed to the next subject, I will say one word further in favor of the system of ventilation at the naval academy. Of course the exit of foul air was presupposed. You have only

to satisfy yourselves that you cannot force fresh air into a place without forcing the same quantity out, by trying to blow into a bottle. For a long time in the navy the bottle system of ventilation was the only system we had. They attempted to force pure air into the ships without allowing the foul air to escape. The system now in operation in some of our best ships is simply that of aspiration; but where we have to depend on automatic means, as in private life, the most feasible is by the fireplace and the window, where the air is allowed to enter the room above the head. As it enters, the current rises and falls in the centre of the room, and the effects of draughts are not felt.

The next paper in order is "On Poisonous Cheese," by Prof. V. C. Vaughan, M. D., of the state board of health of Michigan. (See page 241.)

The PRESIDENT.—The committee of arrangements desire the members to bear in mind that they are to assemble at the Southern hotel to-night at 7 o'clock, so as to be able to take the carriages promptly at 7:15, and be delivered here at 8:15. The programme for this evening is a very interesting one, a rather long one, and we have to begin promptly. Is Dr. Lindsley here? He has Prof. Brewer's paper.

A MEMBER.—He is sick in bed, and he asked me to say when his paper was called that he had it in his possession, and that he didn't think anybody else could read it, but he would probably be better this afternoon, or be present at the evening session, and read it.

The PRESIDENT.—Very good.

A paper on "The Milk-Supply of Large Cities" was here read by J. Cheston Morris, M.D., of Philadelphia, Pa. (See page 246.)

The PRESIDENT.—Gentlemen, I hope you will not leave. These are two very interesting and valuable papers,—one on "Cheese," and one on the "Milk-Supply of Large Cities,"—and fortunately we have some members here who are competent to discuss them to our instruction. Will Dr. Sternberg have something to say about cheese?

Dr. STERNBERG, U. S. Army.—I do not feel really able to discuss the paper in a proper manner, but I consider the investigation a very important one, and I do not doubt but that Prof. Vaughan has arrived at a correct conclusion. To give you my reasons for agreeing with Prof. Vaughan would take too much time. There are, no doubt, a large variety of bacilli in nature, a large number of distinct species which have not been classified, and I am extremely anxious that this investigation may be prosecuted as opportunity arises, and that we may study the whole question from a chemical and pathological point of view. Now, it occurs to me that the proper way to get at this matter would be to get specimens of cheese which had produced these special symptoms, to isolate all the different kinds of organisms found, and make pure cultures of them. I think there is a good prospect that the question will be settled in a satisfactory manner if the investigation is further prosecuted.

The PRESIDENT.—Dr. Davenport is the inspector of milk of Boston. He has been quoted by Dr. Morris, and we would like to hear him on this subject.

Dr. Davenport, of Boston, Mass.—I had not thought of saying anything on this subject to-day, having brought a paper of my own, which I was to read at a later stage. It is true, as he says, that, after a long inspection of milk in the city of Boston, the most common adulteration was the removal of the cream. In large cities there is a large demand for cream for the people who wish to use it in coffee, and for other purposes; and the common way was to obtain it from the tops of the cans, and the result was, some people had cream, and others skim-milk. A great difficulty was found in allowing the sale of skim-milk, and preventing its being sold as whole milk. In the state of Massachusetts the sale of skim-milk is allowed, but only under stringent regulations. It is required to be labelled in such a manner that nobody can buy it without knowing it is skim-milk; but human nature is such that it is hard to enforce the law. I believe New York has had the same law, but has given up the attempt to enforce it. There are some other things in connection with this subject which I have prepared in a paper, and will have the pleasure of reading it to-morrow.

Dr. Raymond, of Brooklyn, N.Y.—There is one case of cheese poisoning that has come to my attention. Two families and another individual were affected by the same specimen of cheese. I regret that these cases all occurred prior to the information which we have received from Dr. Vaughan, and therefore no tests of any kind were made, except the ordinary tests for mineral poisons and alkali; and these tests resulted in nothing. In the Brooklyn case, the specimens of cheese were pressed dry. There was nothing to indicate an undue amount of moisture. The test he refers to was not made. I think we are inclined to attribute too much to any particular sanitary measure, and I feel that it is necessary to say a word or two about the improvement in the death-rate of children under five years of age, during the past two years in the cities of New York and Brooklyn, as being due to milk. I believe impure milk is one of the great elements that work in the production of disease, but I think there are other elements equally as important. The reduction of deaths in children under five years of age is due very largely to the fact of having a very cool summer, and a rise and fall of the death-rate among children of that age is almost always coextensive with the rise and fall of the thermometer. It is a thing, sir, which cannot be produced without something's acting as the agent. I believe there is no more important work that belongs to the health officers than the inspection of the milk-supply. When we commenced in Brooklyn with our systematic milk inspection, we found that 46 per cent. that was sold was skim-milk, and the average adulteration was 14 per cent. water. After two years of persistent work, we have reduced the amount of adulteration to 5 per cent., so that at the present time in our city we have 5 per cent. only of adulterated milk. This has been brought about by the prosecution of the men with whom the adulterated milk was found. I don't believe that adulteration is always attributable to the farmer. The middle man is the man in the majority of cases. We find it a very common practice for the retailer to water the milk. That

is very common where there is a strife between the retailers, and they want to draw custom, and give a greater quantity of it. As the druggist sells postage-stamps, so they will sell milk to attract custom. We have tested the milk from Long Island, and while we have found it coming in adulterated, in the vast number of cases it is the dealer. We hold the dealer responsible. We have our inspectors going around at all times, day and night. A man never knows when his milk is going to be tested. The cans are tested, and if the milk is not all right he is handed over to the police, and fined $20 or $50, as the case may be. The fact that this reduction has taken place in the amount of adulteration satisfies me that the adulteration is practised, not by the farmer, but by the dealer himself, who sells it to the consumer.

Dr. Reed, of Mansfield, O.—I just want to add one word in regard to cheese poisoning. It happened to be my lot, in a Western reserve, to have several of these cases come under my personal observation, and for my own benefit I undertook to discover the cause of the sickness. I found the sensation occurring from eating poisonous cheese very similar to that of persons eating fermented fruit, or fermented substances of any kind, that are under a process of decomposition. I made a visit to several of the manufacturing establishments, and I took occasion at different times to examine into the process of cheese-making from its beginning to the time it is finished. I found the whole process was under one general management at Wellington, O. All the different manufactories are under their control. There was no difference in their manufacture of cheese, but they do make it differently at different times in the same establishment. Now, I found this poisonous cheese was due to the cheese being over-fermented. After the curd is prepared, and ready to go into the press, it is allowed to ferment, and get a certain amount of acid in it, and then it is put in a press and pressed out. Some of the cheeses are pressed dry: others are pressed not so dry. It is these cheeses that are over-fermented; and those that are not pressed dry is where the poisonous cheese nearly every time occurs. Hence, I have come to the conclusion, and did at that time, that the poisonous cheese was the result of over-fermentation. I am satisfied that the bacteria occurs simultaneously with the fermentation occurring in cheese. This poisonous cheese did not occur when it was pressed dry. They said the object of fermentation was to make it light, open, and porus. They left it moist, so that when the cheese would reach its destination it would not be dry: it would retain a certain amount of moisture. The result has been poisonous cheese. At certain times, while they are curing a cheese, there is a preparation that they spread over the cheese which prevents the moisture from escaping, and they put more of this preparation on the cheese that is sent abroad than on that that is used for home consumption; and it has been my conclusion in this whole matter that this poisonous cheese was due to fermentation. The sickness produced by eating this cheese was similar to that produced by eating any fermented food containing an amount of acid.

Dr. Newton, of Paterson, N. J.—I have seen one case of cheese poisoning that was not so carefully followed out as the case he has had under his charge. I tried an experiment, taking a very small drop of acid, souring it with bread crumbs, and swallowing it. It was followed by the same straining, intense burning in the stomach, followed by nausea and diarrhœa. In regard to Dr. Morris's paper, I am sorry there are two or three points that I shall have to dissent from. One point Dr. Raymond has alluded to—infant mortality. We can quote statistics to suit either side. The death-rate in New York and Brooklyn has been low this last season. It happened to be a very cool summer, and if you will remember the summers of 1881 and 1883 in Brooklyn, Boston, and New York, you will remember it was very muggy weather. I do n't wish to give any impression that impure milk has nothing to do with the infant death-rate. It has a great deal to do with it. Another point Dr. Morris seems to hold forth as the panacea to prevent the sale of impure milk,—that is, the sale of it in labelled bottles. The fact is, that Dr. Morris's dairy is well known all over Philadelphia, and there is no doubt other men in the same business, who have the same reputation for pure milk, are known in every portion of the city; but there are other men who conduct business in the same way, bring milk to the city, and adulterate it. I know one case that came under my own observation, where a large dealer in bottled milk placarded the town with the announcement of the superiority of the milk he sold, and physicians endorsed him as to the cleanliness of his dairy, etc., but I myself discovered skim-milk in his buckets. So that is not the universal panacea. It will work well enough where the dealer is honest.

Dr. Morris, of Philadelphia.—Was his name placed upon the bottles?

Dr. Newton.—The name was on the bottles. I do n't like to make any personal announcement as to who the person was. As to the milk-supply of cities, there are a great many statements made by health officers as to the impurity of the milk-supply.

Out of curiosity I had a friend of mine collect a large number of samples in different parts of Philadelphia, and they certainly took the medal for inferiority. As to where the adulteration is practised, it is not always the middleman who does the adulteration. It starts at the farm, and the water is added gradually. It passes through four or five hands, and it gets a pretty high dilution before it is served up to the consumers. During the latter part of 1883 and this year (1884), the milk-supply of Brooklyn, New York, and New Jersey has never been better, and it is now difficult to find a can of impure milk coming into Jersey City to be distributed in New York. There have not been fifty cans of impure milk sold in the city of New Jersey and the city of New York for the last six months. As to the method of pursuing the adulterator, it is no easy task. It is up-hill work. Even if you get a conviction, you find the case will be carried to the superior court, and you are harassed and bothered, and unless a man has a superior order of back-bone, he is forced to resign as milk inspector.

Dr. Comstock, of St. Louis.—I was very much pleased with this paper of Dr. Morris's. As a practitioner of medicine, I do n't think it is overdrawn at all. Infant mortality from impure milk is very great. We have a great deal of trouble with impure milk in our hot climates. I was very happy to hear his remarks with reference to having milk put up in bottles. I have never heard of that before. Our friend Mr. Cabanne gives us the best milk in St. Louis, and if we could get hold of those bottles for infant patients, we would be sure we were getting good milk. It is a difficult question how to get pure milk, and how to bring those who water the milk to justice. I do not know that we can do that. In a great many dairies here in St. Louis the cows are fed with slops from the stills, which certainly gives us very bad milk. As a member of the humane society, I can say we have tried to prevent that. We have done a great deal, I think, to improve the condition of the dairies in that respect and in many others. It is a question, I think, of a great deal of importance, and should be very thoroughly discussed. I think our friend Mr. Cabanne can tell us something about how cows should be properly fed.

The association took a recess until 3:30 P. M.

AFTERNOON SESSION—3:30 P. M.

The President.—The association will please come to order.

The association this afternoon will be entirely occupied with the consideration of communications from the representatives of the state boards of health. We are ready now to hear from any of the members of the state boards.

Dr. McCormack, of Bowling Green, Ky.—At the meeting, yesterday afternoon, of the Conference of the state boards of health, Drs. Reeves, Baker, and Conn were appointed to arrange a programme for this afternoon, and I think it might be well to have them state the order in which the business is to be conducted.

The President.—Are there any of the members of that committee present—Drs. Reeves, Conn, or Baker?

Dr. Baker.—Dr. Reeves is the chairman of that committee, but I think it was the understanding of the committee that we would ask the secretary of the Conference of the state boards of health to give us an outline of the conclusions of the representatives of the state boards of health at that Conference; and if it is agreeable to those present, that will be the view of the committee. Afterwards we can hear from the states, called in alphabetical order.

The President.—Will you be good enough to give us an outline of the Conference of the state boards of health, Dr. McCormack?

Dr. McCormack.—Mr. Chairman, I will present the report of the Conference of the state boards of health. It reads as follows. (See Reports of Committees.)

The President.—You have heard the report of the secretary of the

Conference, and the statement that it has been proposed by the chairman of the committee which had charge of the programme of this afternoon's session, that the states be called in their order, alphabetically, for the expression of the views of the representatives of the several state boards here present.

A MEMBER.—Would it not be better that this communication from the Conference of the state boards of health, just read by the secretary, Dr. McCormack, be accepted? I make that motion.

Motion adopted.

A MEMBER.—Mr. President, I wish to inquire whether the states as called are to give their views on this subject, which has already been decided, as I understand it, by the Conference, or whether they are to state what is being done in their states by their state boards of health.

The PRESIDENT.—We have accepted the report, and now the remarks that will be made will be in commentary upon that report.

A MEMBER.—My opinion is, that when the states are called they should also state what are their several plans of organization, and what work had been done there.

The PRESIDENT.—That will be so understood, if desired.

A MEMBER.—It occurred to me that we should have an understanding as to that point. It seems to me, as the matter comes before us now, that every member of the state boards of health would be at liberty to occupy a certain amount of time, say five minutes, on this or any other subject. Is it not better that we should consider this separately? Say we give three quarters of an hour or half an hour to this one subject of cholera, which is so prominently before us; that we give the time to that, limiting the time, and allowing any gentleman who may wish to express himself upon it to do so.

Dr. BAKER, of Michigan.—I move, sir, that before taking up the states in their order, to hear as to the work in the different state boards, we spend half an hour in a discussion upon this report of the Conference, the time being limited in this first half hour to five minutes to each member.

Motion adopted.

The PRESIDENT.—Instead of calling the roll of states for a discussion, this matter is before the association for the expression of their views?

Dr. BAKER, of Michigan.—Yes, sir.

The PRESIDENT.—Very good. The speakers will be limited to five minutes. The report is before us for discussion by the association, without regard to state membership.

Dr. HUNT, of Trenton, N. J.—I have very little to say about this at this time. I merely wish to say, first of all, that the report seems to be an admirable report; and yet, when it was before the Conference, I thought then, as I now do, that the American Public Health Association will go far beyond that report. The report is an excellent one, but it seems to me, if we are to go before the country in reference to the question of cholera, we have got to do a little more than deal with certain points in

such a report, which must be general. The report says that thorough disinfection shall be done in a manner similar to that recommended by the National Board of Health. Now, sir, the American Public Health Association will be ready to take a step far in advance of that. (Reads from Report of Committee.) It seems to me that we should not only adopt this report, but that we, as an association, should in some form raise a committee that would be ready to aid our executive committee; and if necessary, if any emergency or exigency should arise that seems to call for it, it shall leave the executive committee at once, to call together the association for any object; or, if not doing that, at least to be able to issue a kind of a circular that shall have far more power than the circular of any state board of health or municipality.

Dr. Devron, of New Orleans, La.—As a member of this association, as a delegate from the city council of New Orleans, and as chairman of the public health committee of the council, I now rise to inform you what the city of New Orleans will do. As we are not here as a member of the state board, and therefore have had no occasion to speak in the meetings of the board of health, the city council, in view of any epidemic or any contagious disease occurring, has already passed a resolution that the commissioner of public works and the commissioner of public buildings shall have authority to mass their workmen and their laborers or employés at any time, upon any point, to make rapid work. The city council will be prepared for the work of purification or disinfection. We have ample means from various funds to meet any emergency of that kind, should it be necessary; and whenever the board of health of the state of Louisiana shall point out a source of danger, the city council, with its means and its laborers, is ready to assist that board in checking that disease.

Dr. Pinckney Thompson, of Kentucky.—I have but one suggestion to make about that paper now. We all know, from our experience with epidemics, that when disease, say the yellow fever, for instance, finds lodgment on American soil, our quarantine does not amount to much. With all our boasted quarantine, when disease once gets a foothold, either in New Orleans or any other seacoast city, we have generally seen it go as it saw fit. Inland quarantine is one of the hardest things in the world. in the first place, to establish, and the next thing, to maintain; and every railroad that is built, and every wagon-road that is cut through the forest, makes it more so. It would take every man, sir, in the country, to quarantine against New Orleans, or New York, or anywhere else, if cholera were to land here. Our whole safety, in my judgment, lies in our government, in not permitting it to get here. It has the power, it has the money, it has the ships, and it has the guns and the men; and no city or municipality has, and no board of health created has ever had, the power to exercise the functions that the government can confer upon its own officers. Therefore, sir, I hope that our whole discussion will be confined to keeping it out of the country entirely, and of bringing this whole association, independent of the state boards of

health, or municipalities, or anything else, to bear upon congress and upon the government in this direction; and especially in its legislative and executive departments, to take action upon this question, and take it now. It will do no good when the thing gets here once; and I hope that this association will sanction any efforts the state boards may make to bring to bear upon the government that it is our duty, our privilege, our power, and our money, that is going to keep it out of the country.

Hon. Mr. BROOKS, of Richmond, N. Y.—Mr. President, I wish to make a motion, sir, which I believe will not be out of order. It is, that the paper which has been read to the association this afternoon be printed, and copies of it transmitted to the president of the United States, to the cabinet ministers at Washington, and to each of the senators and representatives in congress, and that that paper be distributed under the authority of the association, and that it bear the signatures of its official officers.

Now, sir, there is a great deal of diversity of opinion as to the cause or causes of cholera. There is no diversity of opinion as to the consequences of cholera. We are all united in the opinion of the necessity of preventing, if possible, the introduction of this terrible and mysterious disease into the United States. A work of preparation is a great work, and it is a possible work of the United States to do. It is a possible work for every state board of health to contribute to, for every municipality to contribute to. It is a question which attracts the interest, not only of the local, state, and national organizations, but of every intelligent and well-minded citizen in the United States. It therefore seems to me to be eminently proper, convened as we are at this time in our annual meeting, to take such notice of the subject as will bring public attention to its importance, and especially those who are appointed to represent the states and the several congressional districts of the United States. Now, sir, in regard to quarantine, which has been incidentally discussed here, I think we cannot too much magnify the importance of what is understood to be the American quarantine system. It is as unlike the European system as light is unlike darkness. I remember forty years ago (and the system has not been changed very much in Europe from that time to the present), when I was upon the Danube river, and desired to make my way to Constantinople, to which place I had paid my fare, I was met by the obstruction that nobody could enter Constantinople (that was in the year 1843) without being stopped upon the way for a space of thirty days. It was therefore a physical impossibility, limited as my time was, to make the visit which I had long contemplated, and which interested me exceedingly. Th quarantine system of Europe is a brutish system, cold-blooded, unnatural, and unnecessary. The quarantine system of the United States, as I have seen it and as I understand it, is merely the proper care of persons possibly infected with a disease, and the proper care of ships and dwellings, materials and goods, to prevent the infection, or what may be contemplated by such infection,—to prevent, if possible, the spread of the disease. Now, I

have known a ship to come into New York with ship fever—a very disagreeable disease. It spreads itself not only amongst those on board, but, by communication with other persons, communicates itself to others; and I have known the small-pox to be introduced in the same way. Yet, by a proper quarantine system, confining the contagious persons, or those afflicted with the contagious disease, to one island, and those who have been afflicted with it and are convalescent to another,—sending them to one of the two islands in the harbor of New York,—I have known the spread of that disease to be wholly prevented. Now, I think we ought not to have any prejudice in this country against the quarantine system, such as has become the practice of the people of the United States.

Dr. Watson, of Concord, N. H.—I move, as an amendment to that resolution, that a sufficient number of copies be printed to send to the various state and municipal boards of health, in addition.

A Member.—Does this involve the endorsement by this association?

The President.—Naturally.

Dr. Bryce, Toronto, Can.—Are these copies to be sent to the health officers of the Dominion of Canada?

Mr. Brooks.—That is included.

Motion adopted unanimously.

Dr. Hibberd, of Indiana.—I do not propose to discuss the subject of quarantine, knowing very little about it. I have not been so unfortunate as the gentleman who preceded me, as to be stopped on the Danube. We got on the rocks, but we were not stopped by quarantine.

In relation to the matter that was mentioned a while ago, about the advancement that has taken place in the views, possibly, of the members of the National Board of Health, certainly in the views of a great number of other gentlemen, in regard to the relative value of disinfectants and germicides, we may express the hope that this body may establish, by resolution or otherwise, a committee to investigate that subject, and report.

The President.—Our business this afternoon concerns solely reports from the state boards of health.

Dr. Hibberd.—I understood that the report of the Conference of the state boards of health should be open for discussion.

The President.—Not now; it has been adopted.

Dr. Hibberd.—It has been adopted, but there were thirty minutes assigned for it, and five minutes for each one who wished to speak. I have a resolution in my pocket now, which, if I can learn the proper time to offer it, I shall present to this association.

The President.—Offer it now, then, as a few minutes remain of the half hour.

Dr. Hibberd.—I will offer this resolution:

Whereas, Within a few years there has been a large increase in the knowledge of disinfectants and antiseptics and germicides, both abstract and practical; and

Whereas, It is important, equally for practitioners, for boards of health, and for the

general public, that the highest attainments of science in this department of sanitation should be formulated for easy reference by all who need it for practical illustration,—and especially is this desirable in view of the probable visitation of cholera in this country in the near future; therefore,

Resolved, That a committee be hereby constituted to examine the subject of disinfectants, antiseptics, and germicides, in their relations to preventive medicine and sanitation; and that said committee formulate a table of these agents for the information of those interested, the agents to be classified, so far as may be deemed advisable, according to their specific virtues, facility of application, and economy of use.

The President.—You have heard the resolution. It has been moved and seconded that it be adopted. Are you ready?

Dr. Thompson.—My recollection of the constitution is, that that paper would have to go before the executive committee without debate, and they would report it to-morrow morning.

The President.—You are quite right, Dr. Thompson.

Dr. Hibberd —I hope it will be entirely within proper usage and courtesy to say I hope that Dr. Sternberg will be chairman of that committee. The point is, that we take some gentleman interested in this matter, who has given it some attention, careful and thoughtful study, that he can, without the expenditure of a great deal of time, or without further experimentation, be able to lay down what is now known as to the value of these various agents for the purposes mentioned, and to classify them in a way that will give to the state boards if they choose to adopt it, to the municipal boards if they choose to adopt it, and to the individual practitioner, in a concise way, an opportunity to decide just what ought to be done in any given case. It is undoubtedly true, I suppose, that some of these agents which have been in common use are good for nothing; that others are valuable for certain purposes; and that others are still more valuable for certain purposes. Now, I say all these things are in the minds of some gentlemen that can be put upon that committee, and the whole thing can be formulated, and the order come up, in view of the Conference to meet in December. I sincerely hope it will be all arranged, and made as extensively as it is possible to be made, in the present state of science, by that time. (Applause.)

Dr. McCormack.—It seems to me, sir, important as is the action taken by this association in regard to this report, and such weight as it will undoubtedly have when endorsed, as it will be endorsed when it is presented to the president of the United States and members of congress, that there is another work which can be done by the members of this association before congress assembles, which may be of vital importance in dealing with this question, and that is, that the official sanitarians throughout the country, and those who are in this body who in a few days are to return to their homes, shall use their personal influence with their representatives in congress to secure such national legislation as we desire. Most of the members of this association who have spent much time about state and national capitals know how difficult it is to get the attention of legislators while engaged in their active duties; and it does seem to me, sir, if we desire to impress them thoroughly with

the importance of this question, as I know we do, that the way to do a large part of this work, the way to make what we think and what we say effective, is to see these men at their homes, and, as members of state and municipal boards of health and as individual sanitarians, spend half an hour with them in impressing upon their minds the fact that, first, we are threatened with cholera; second, that its introduction into this country can be prevented, and ought to be prevented; third, that it is the duty of the national government to take such action as to secure this end. I believe that half an hour spent with any member of congress at his home, discussing in a plain, practical, and common-sense way, as would be done on this question, would have more weight, sir, than the combined action of this association with the state boards of health, or any other influence that might be brought to bear upon them when they are busy with their committees and with their other duties in the national capital. Endorsing as thoroughly as I do all that has been said by the gentlemen who have preceded me, I want to insist upon that part, that, if it is as important and if it is as practicable to prevent the introduction of cholera into this country as this report intimates, and as the remarks of these gentlemen indicate, there is an individual responsibility resting upon the members of this association that cannot be delegated to the officers of this body, to the representatives of the state boards of health, or to anybody else; that there is an individual responsibility resting upon us at our homes, in connection with this matter, that is of vital importance.

Dr. Early, of Columbus, Ohio.—I heard of a judge on the bench once, during the trial of a case in which there were three litigants, deciding in this manner: The attorney for one got up and made a speech, and a very forcible one. He sat down, and the attorney for the opposite side got up and did likewise. The judge turned to Mr. A. "Well," he says, "Mr. A., I must confess, sir, you have made a very striking and a very forcible argument in this case. Mr. B., I must say to you, sir, that you have also made a very striking argument, and you have made a beautiful speech and a very forcible one; and such is the impression made upon me, sir, that I cannot determine this evening which way to give my decision, either in favor of Mr. A. or of Mr. B." These gentlemen in their remarks have impressed me with several lines of thought. The position taken by Dr. Thompson I realized to be a fact in the opening of his speech. I have had the misfortune, sir, to pass through two or three epidemics, and have been a victim of the disease myself. In the midst of the plague you can get the politician and the leading officials to do anything on the face of the earth, sir, to save their lives; but as soon as the danger is gone, sir, they turn their backs upon it, and look forward to the future which may be, in their eyes, looming up with personal prosperity and with the country's success. Thirty days afterwards they forget the calamity that was overwhelming them, that has cursed the cities and travelled through the country, when, if it had been taken in the beginning, might have been suppressed; and he that voluntarily

permits ruin to come upon his people by negligence is a criminal. The resolution offered by Dr. Brooks and by Dr. Hibberd all answer a good purpose, sir, up to a certain point. You may write letters, you may make resolutions, and you may map out a course for the medical fraternity of this country to pursue, and send it to every individual belonging to the government who occupies anything like an official position, and the probabilities are, sir, that he will fold it up and put it in his pocket, and say, "That belongs to you doctors; we have nothing to do with it." Dr. McCormack has suggested the line of policy to be pursued by the medical men and by the citizens at large. Let every man feel that it is his duty when he goes home and comes in contact with these parties; and if he is not necessarily thrown with them in his business, let him make it so. Let us individually make such an appeal to our representatives as will induce them to lend an ear, sir, to our future.

The PRESIDENT.—Gentlemen, we have exhausted the half hour. Now, as I understand the programme, we are to call upon the members of the state boards of health for any statement they may see fit to make respecting the working of their several boards.

IOWA.

Dr. ROBERTSON, of Muscatine, President State Board of Health.—The state board of health has been going on with its regular work. The secretary of the state board of health was preparing a report for this meeting with reference to the action and operations of the board during the past two years; but just about the time this paper was assuming shape he was unfortunately taken sick, and died, leaving the work for this meeting unfinished.

ILLINOIS.

Dr. RAUCH, of Springfield, Secretary of the State Board of Health.—We expect from the first of January, or thereabouts, to commence a systematic sanitary survey of the state, and we hope by the first of June, if possible by the first of May, to place the state in as good sanitary condition as is possible.

INDIANA.

Dr. ELDER, of Indianapolis, Secretary of the State Board of Health.—We have been endeavoring to place our state in as good sanitary condition as possible. To that end, during July we issued an order to town, city, and county boards of health to make a survey of their respective localities, and correct, so far as possible, the hygienic faults that were to be found. We have had a survey made of the school-houses, a sanitary survey made of all the prisons, a sanitary survey made of all the poorhouses and a number of our state public institutions. We appreciate the danger of an attack of cholera, and are attempting to instruct our people in plain language in regard to the preservation of their health,

and to prevent, if possible, its introduction, and the spread of the disease if it should be introduced. We have sent out circulars of instruction to all the railroad officials of our state, calling their attention to the railroad property, and its cleanliness, disinfection, and sewerage. In most all cases the railroads have responded kindly, and have taken such action as has been suggested.

KENTUCKY.

Dr. J. N. McCormack, of Bowling Green, Secretary of the State Board of Health.—The Kentucky State Board of Health was organized in 1878. The appropriation for its support was small, but in spite of this, and in the face of many difficulties, it was making yearly progress, and accomplishing much excellent work. Local boards of health had been organized in 103 of the 117 counties in the state; a sanitary survey of many of the counties had recently been completed; an investigation of the influence of the floods of 1883 and 1884 upon the public health was being made; well arranged and well attended sanitary councils were being held; and last, and probably most important, the study of hygiene was being introduced into all the public schools of the state.

At the outset of its career the board had recognized that the chief obstacle to its usefulness lay in the dense ignorance of the general public in regard to the plainest and most important health requirements—ignorance of the fact that such a thing as sanitary science exists, or even seriously pretends to exist. It began early to insist that every child in attendance upon our public schools should receive instruction as to the means of preserving health and life. During the present year they had succeeded in having the "Laws of Health" made by law a part of the regular school course, and the board would make every effort to secure an intelligent enforcement of this law, believing, as they did, that the school-house was the most promising field for securing a foundation for a permanent sanitary reform.

LOUISIANA.

Dr. Herrick, of New Orleans, Secretary of the State Board of Health.—There are three quarantine stations near New Orleans, and others may be opened at the discretion of the board for the protection of the city. Railroad quarantine stations have been instituted at different times, not this year, however, as it has not been deemed necessary. An inspecting station has also been established at Port Eads, at the mouth of the river.

The quarantine inspection continues throughout the year at the Mississippi station, about seventy miles below the city, but the proclamation declaring the particular time of detention has always gone into effect about the first of May. It has terminated heretofore about the first of November. The quarantine detention went into effect this year on the first of May. The proclamation, withdrawing the detention, has already been issued, to take effect the first of November. The period of deten-

tion, fixed by the proclamation in April to go into effect the first of May, was ten days. This continued till the 15th of July; but previous to the 15th of July the board of health decided, in view of the immense importance of excluding yellow fever from the country this year on account of the Exposition, that additional measures were needed, that is to say, a longer time of detention was imperative, and consequently the period from certain ports known to be infected was extended to forty days.

The board has in view a system of quarantine of which sanitary measures constitute the most important feature; but this has not yet gone into effect, and cannot this year. Consequently it relies upon the detention of forty days, which amounts to non-intercourse for the present only. This detention of forty days, however, relaxed from the 15th of September, and by that time the outlook abroad was so favorable that the period of detention was reduced from ten days to five days from the first of October.

With respect to cholera, the board of health adopted a resolution in the early part of July, that vessels from ports known to be affected with cholera at that time, or which hereafter might become so, should be detained at the quarantine stations at the pleasure of the board until further notice. The board has not taken any definite action so far in regard to the course it would pursue in those cases. Vessels will be detained, and the board will take such action as it sees fit when the necessity actually arises. Only one instance has yet arisen in which there was the slightest ground for alarm or even suspicion. That was in case of a steamship which recently arrived from a foreign port, and which left there about the fourth of September, or about the time when cholera was reported there. The board ordered this vessel to be detained five days at the quarantine station. That was the only case which came under the resolution.

The sanitary functions of the board of health of Louisiana are confined to the city of New Orleans. In this respect there has been an unusual amount of work done, with the assistance of some extra force detailed by the officers of the sanitary association.

MARYLAND.

Dr. Chancellor, of Baltimore, Secretary of the State Board of Health.—I regret to say that the legislators of our state seem to appreciate much more highly the lives of cattle than of human beings; but with the small appropriation we have had, we have been enabled to accomplish much good, and with larger appropriations we will accomplish a great deal more.

The work we have done consists of inspection of public institutions. In 1875 I was directed by Governor Carroll to examine the condition of these institutions, and the investigations made have been productive of a vast amount of benefit. Our principal work, however, within the last year, has been an effort to educate the people in matters of sanitation,

to induce them to believe that there is more virtue in prevention than in cure. We have endeavored to do this by holding sanitary councils. Within the last year we have held two councils, the first in the city of Baltimore, and again in September last, in one of the counties of the state. This last council was largely attended: I suppose there were one hundred and fifty persons present at the meeting.

We have not confined ourselves to the medical profession in this work. We invite all classes and occupations, and this has been remarkably successful. At our last council a great deal of interest was taken in the matter. Outside the medical profession, farmers, lawyers, plumbers, and even ladies, were present and took interest in it. There were a large number of papers read, I think some twelve or fifteen, of unusual interest. We believe that this system of educating the people in the laws of health will be more beneficial, and really more useful, in restricting the advent of disease, cholera especially, than quarantine. We have sent out a large number of circulars from time to time in reference to various diseases, and we have been called to a number of the villages and towns in the state where nuisances existed which would probably occasion ill-health. I have within the last three months made not less than five inspections of these places, and I am glad to say that where these nuisances existed it has only been necessary to call the attention of the parties who created the nuisance to the fact, and they have in every instance been willing to abate it without any resort to law: in not one single instance have we yet found it necessary to resort to law. These parties are advised as to proper means for cleansing their premises, and what is necessary to protect the health of themselves and their neighbors, and they have invariably shown a willingness to conform to such instructions.

We have made an effort to establish throughout the state local boards of health, for there is no law upon the subject, and in nearly every county in the state we did organize local boards of health; but the failure of the legislature to make any appropriation at all, or to require the counties to make any appropriations to support these boards, or to pay even the necessary expenses, has given rise to a great deal of indifference on the part of those who took an interest in the matter, for the reason that they were not willing to work for the public and pay their own expenses.

MICHIGAN.

Dr. Baker, of Lansing, Secretary of the State Board of Health.— Mr. President and Chairman: I regret that I overlooked, in the programme, this requirement, and that I have not prepared myself on this question. I may, however, be able to interest you by speaking of one or two salient points in the work of the Michigan board which may be different from the work of other boards, and in the plan of its organization. I believe the Michigan board was the first board organized on its plan. It has no mandatory powers in respect to nuisances. All its functions

are advisory. It seeks to induce others to do the local work. It collects and disseminates information, and strives to stimulate the local boards of health. To do this it has secured amendments to the laws, which, when the state board of health was organized, provided that certain officers in each township should be a board of health. These officers were not obliged to meet, and in fact they did not meet, consequently there was no action. One of the first efforts of the board was to secure a working local board of health in every township, city, and village in the state; and to do this they had the law so amended that the "township board" should be the board of health. In order to maintain the township organization, this township board has to meet once every year. There was that much gained—there must be a meeting of the board every year. Then they secured the amendment to the law in such a manner that there *shall* be a health officer. Previously there *might* be a health officer, but as a matter of fact there were no health officers in the townships. The law now requires that there shall be one, and that his name and post-office address must be reported to the state board of health. One important part of the work of the state board has been to stimulate the appointment of these local officers, and to get in close correspondence with them; and now there are about fourteen hundred local boards of health in the state, nearly every one of which has a health officer, and we have his name. The names of the health officers in our state have recently been printed.

Another line of work that may be of interest is the collection and publication of reports of sickness; and inasmuch as it is not done, I believe, by any other state board of health, I think that may be of interest. I am frequently asked of what use it is to get reports of sickness from a few places, when it is utterly impossible to get the reports of all the sickness in any one of the places. We act upon a principle which is the same as that which governs the man who buys wheat on the street. I do not know that all of you live in wheat countries, but up our way, when a man comes on the street to buy wheat, he looks in the top of a bag of wheat to see what that bag of wheat is like, and he places his estimate of the wheat in that bag upon what he sees in the top of it; and he examines one or two bags, and he buys that wheat. He invests his money in it. What he does with one load is done with reference to the entire crop throughout the state. He invests his money in that wheat from the little he has seen. He supposes that is a sample of the whole. He does his business in that way. We do the same. We act upon that principle in getting knowledge of the sickness throughout the state. We took a list of the members of the state medical society, a list of prominent physicians, and asked that they would act as correspondents of our board, and reply to questions put to them. Thus we secured the co-operation of a large number of prominent physicians of the state. Those who would make a report of sickness in this manner were asked to do so. The law entitled us to demand of the health officer of every city and village a weekly report of the sickness; and we asked, not for the sickness

under his jurisdiction, but simply the sickness under his observation. The question we put to him each week is printed on a postal card, addressed to the state board of health, and copies of that postal blank are enclosed in an envelope addressed to the physician. The diseases are named in alphabetical order, and the question he is to answer is, Did you observe, during the week ending Saturday, such and such diseases? and when he replies, we thus have a list of the diseases under his observation during that week. We have those reports from a large number of physicians in the state. These reports are compiled, and there goes out from the office every Wednesday a statement of the diseases which caused the most sickness throughout the state in the preceding week. It is published in about half of the newspapers in the state. A similar report for each month is sent to a number of medical and sanitary journals. For an annual report, we compile those postal reports in such a manner as to show which diseases caused the most sickness throughout the year, and which diseases caused the most sickness in each month, and the order of the prevalence of the several diseases, down through the list. We think that by means of the weekly reports of sickness we get valuable information; and it is as reliable as is the usual mode of doing business, in which, as in the case of the wheat crop of Michigan, millions of dollars are invested annually.

Some may think that this is not carried on with the precision we ought to have in a scientific study. I think we will wait a long time before we will secure reports of all the sickness; meanwhile our method is very useful. We have adopted that method, and we have no reason as yet to think of leaving it.

MINNESOTA.

Dr. C. N. Hewitt, Secretary of the State Board of Health.—As requested by the resolution, I submit a brief statement of the work of our board, and of the local boards throughout the state.

Organization. The state board is organized under a special act. The local boards are now organized under a general statute, and anything in their special charters to the contrary, notwithstanding, are given common form and authority. The boards of supervisors of townships are the local boards of health. They are not required to have a physician as health officer, unless ordered to elect one by the state board.

Incorporated towns, villages, and cities are required to have a local board of health, to consist of at least three members elected for one, two, and three years respectively, one of whom *must* be a physician and health officer, the executive officer of the board. This plan of organization, and of coördination, between the state and local boards of health, while it secures to local boards perfect freedom of action as respects matters of local concern, at the same time enables the state board to weld two, more, or all into a united and efficient body, for the prevention, or control, of epidemic or infectious diseases, either of men or of animals.

Another advantage of our method is the concentration of the laws

relating to health into three or four coördinate statutes, or chapters of a common statute, so that there is simplicity both of direction and method.

The powers of boards of health—local boards. (*a*) To prevent, or control, epidemic and infectious diseases of men.

(*b*) To prevent, or crush out, by quarantine, or slaughter of infected animals, diseases of domestic animals.

(*c*) To control the methods and location of offensive trades or employments, and to remove all nuisances and sources of ill-health or sickness.

(*d*) These powers are supported by specific methods in the text of the law, and by adequate penalties.

(*e*) Further, the law makes their use the imperative duty of local boards and of their health officers, under penalty.

State board of health. (*a*) It is the official adviser of the governor, other state officers and state institutions in matters of public health.

(*b*) It is the guardian of the water-supply of the state, and requires of water commissioners of towns, and of water companies, regular reports of their work. The board makes regular analyses of all public water-supplies, and of the water of suspected sources of private or public supply when necessary. To this end we have a fully equipped laboratory under the personal direction of the secretary.

(*c*) As respects epidemic or infectious disease, the powers of the board are ample, not only as respects its own action, but in the direction and coördination of the work of local boards.

(*d*) Epidemic and infectious diseases of domestic animals. The directions of the state board supersede those of local boards. The board has all the powers of justices of the peace to take depositions, and compel witnesses to attend and testify in investigation relating to this subject. The powers and duties of the board are ample, and clearly defined in the law, as are the penalties for violation of the law and the mode of their enforcement.

(*e*) Offensive trades and employments. The powers are those of the local boards, with such additions as the wider jurisdiction requires. The law is very stringent, and is a copy of that of Massachusetts.

(*f*) The working of this system of sanitary control, all over the state, is facilitated by a simple system of regular reports and surveys, so that at any time the records of the state board office show the condition of any locality as relates to any one or more of the departments of work provided by law.

(*g*) Local boards are supported by local taxes, except as respects the prevention or control of epidemics of men or animals, when the county pay the expense immediately after the work is done. When necessary, the state board employ expert inspectors, at the state expense, to aid local boards; or the secretary acts directly for the state board by personal visit and direction.

The state board has a large reference library for the use of the secretary and local health officers, and the secretary gives every assistance in this direction to health officers which they require. Analyses of suspected

articles of food or drink are made in the state board laboratory. The board publish monthly a journal, "Public Health," of which an edition of 2,000 is printed and widely distributed, as a means of communication between the state and local boards and with the people of the state. It is sent to all the state boards, and to all the newspapers of the state.

Educational work. The secretary is the professor of public health in the university faculty. He has succeeded, through the state and county superintendents of public instruction, in making an examination in the elements of hygiene and the sanitary laws of the state a part of the regular requirements for teachers' certificates.

Conferences of state and local boards have been instituted by the state board, and popular councils for general information are held in different parts of the state.

Interstate coöperation. For many years this board have labored to secure some system for this work, but, for reasons known to the members of this association, without success. We notify adjacent state boards immediately of the existence of infectious disease in our borders threatening them, and ask the same favor. We have such an arrangement with the province of Manitoba. Taken all in all, the results of thirteen years of work on the part of this board have been satisfactory to the state.

The appropriations for the board are,—general expenses, $5,000 per annum; special for cattle disease, $3,000 per annum; special contingent for cholera, $15,000.

I think it proper to add, under the circumstances, that our coöperation will be hearty and cordial with every legally constituted sanitary organization, state or national. We shall not be found wanting in any way in the most cordial support of any measure, legally adopted, for the protection of any part of our country from infectious disease.

MISSOURI.

Dr. G. M. Cox, of Springfield, member of the State Board of Health.—We have been organized only a little over twelve months. We have not a great deal to report. We have had a very good law, though it might be amended in a great many respects, and be better for it. We have, undoubtedly, a very fair law, though. We organized in July last. Our laws embrace the so-called medical practice act, and sanitary matters of the state which we have control of. We have rid the state of a great many irregular practitioners and quacks. We have registered thirty-eight hundred physicians, as the law requires us to register physicians. Those that have been in the state over five years are not compelled to register, according to our law. We have endeavored to establish local boards. We have done that to a considerable extent. We have met with some opposition. Our local boards are expected to report to our secretary any epidemic disease, such as small-pox, scarlet fever, measles, and diphtheria. We have, perhaps, one third of the state organized in that way. Our secretary has got out one report showing the number of

registered physicians. In 1877 Illinois ran into our state about five hundred irregular practitioners, when the board was established there. We have sent them on, most of them. I came across one fellow here in St. Louis who came to register, and in questioning him I asked him with reference to certain diseases, and he fell so far short of knowing anything about them, I asked him if he had ever treated for diphtheria. "Oh! yes, he had seventy-five in his neighborhood." "How many died, Doctor?" "None died." "None died?" Well, I said, "Doctor, you must have a specific for that disease." I saw he didn't understand that. "You must use a medicine no other physician knows of." "Oh! yes, I do." "I should like to know your formula, Doctor." Well, he said he didn't impart that to any one. Finally I insisted, and he demurred. I insisted until he agreed to give it to me. I only allude to this to show you an example of a great many of those men we have to deal with. He said he used black pepper, mullen leaves a handful, apple vinegar a pint, and the last was chamber lye boiled down. Now that is only a case of the many men we have had before us.

The law compels our board to meet twice a year. We have just had a meeting here. At our July meeting we investigated the sanitary condition of the public institutions of the city, and we found them in good sanitary condition. The state is giving us a pretty hearty support. Of course the irregular practitioners, and their uncles, aunts, and cousins, curse it, and say everything they can against the board, but we are overcoming that to a great extent. We hope this winter, by favorable impression upon our legislature, to get a better appropriation; and I was very proud of the amendment, made a few minutes ago, in regard to the printing of these pamphlets, to be given congressmen and other officials. We shall be glad to present them to our members of the legislature.

NEW HAMPSHIRE.

Dr. G. P. Conn, of Concord, President of the State Board of Health.—Our organization is similar to that of Michigan, being largely advisory or educational in its character, and we commenced the education of our people ten years and more before we got a law organizing a state board of health. In fact, becoming convinced that the state required it, that every state required it, that it was a means of saving many lives, I commenced trying to get an organization, and I found the people of my state, very likely the same as in other states, more inclined to regard epidemics as a visitation of providence than as a matter of preventable disease.

Our state is small, and this matter of education or advisory work we find answers our purpose admirably. We find a hearty coöperation, without any difficulty, in bringing about any results which we wish, through our local boards of health. New Hampshire had some extra law regarding public health, but it seems it was a dead letter for the want of some executive or advisory power. Even in the last of the last century we had through New Hampshire an epidemic, which, for the population

of the state, was almost equal to the yellow fever of the South, called then spotted fever, running through the even tier of townships, where in a few months there was a death rate of over six hundred in the population, so that it was nearly twenty-five per cent. of the population. That aroused, as my friend from Illinois would say, the legislature, so that it passed a law; and although the law was not enforced, yet its being left upon the books, and then incorporated into our statutes, leaves us some very good legislation on which we can rely, and which, through our local boards of health, we have no difficulty in enforcing. We have been able, since our organization in 1881, to effect, or rather perfect, our registration so far as to get it incumbent upon every town to have a system of burial permits, so that at our next or second registration report we expect to be able to give nearly absolute figures in regard to our death rate. Of course, in a sparsely settled state like mine, where emigration is fully equal to our birth rate, we are not increasing in population, and it is hard, sometimes, as our census is only taken once in ten years, to be absolutely correct in our percentage, but our ambition is to make it as nearly correct as possible.

I wish that Doctor Watson were present so that he could give you more of the details of our work. We have accomplished a great deal of good work, and I am gratified that the state and the people sustain us in what we have done, and have not yet turned the cold shoulder upon us for anything which we have asked.

NEW JERSEY.

Dr. E. M. Hunt, of Trenton, Secretary of the State Board of Health.—I think we need not say very much as to our board. Its method of work is very nearly that which has been outlined by so many of the boards. The local boards are made up of the township committees, of the assessors, and of a physician. If the physician is not properly appointed by the local board, the state board has the power to appoint him. We have well organized boards throughout the state. They have very large powers, so that they are able to go forward and do great service for their locality. The chief difficulty or embarrassment is, that sometimes the local board is made up of men anxious for popular favors. We were able, three years ago, to pass a law by which the board could not be changed in cities with each political change. Only three can go out of office at any one time, so any political change does not result in an entire change of the board. We have found this a great advantage. The law as to nuisances has been fortified, so that when a case comes before the higher courts we are generally successful.

The system of vital statistics is well organized throughout the state, and the returns are very satisfactory as to marriages and deaths, and satisfactory as to births in most of the townships, but we fail in getting the full returns of births from large cities. The control of the board over the diseases of animals is an important feature. We have the services of

seven veterinary surgeons, and we have had occasion to use their services often.

In case any local health board is derelict of duty, we can examine into it, and report against the board if necessary. We can certainly say, that while there are a great many things undone, there has been much done in the last four or five years and as much progress as we could possibly hope for.

NEW YORK.

Hon. Erastus Brooks, of West New Brighton, member of the New York State Board of Health.—Our state board consists of nine members, three appointed by the governor and senate, three by the governor, and of the other three the quarantine health commissioner is one, the director of the state survey is another, and a distinguished expert physician, Dr. E. M. Moore, is another. These nine members compose the state board of health. The board is five years and a fraction old, and has established, as I had occasion to say upon a previous occasion, about nine hundred local boards of health.

I would like to impress upon you this fact, that while we have considerable power, we have not in our body any mandatory power to enforce what we recommend; but the law gives us power to communicate to the governor offences which exist in different parts of the state, and the governor, when he learns what the people fail to do, upon the persuasion of the state board of health, interposes the executive authority, and secures, as a rule, the necessary remedy for existing evils.

One more word, Mr. President, in regard to a difficulty which exists, I suppose, in every state. New York is on one side of the river, and New Jersey is on the other. There are oftentimes nuisances on either side. We cannot abate a nuisance on the New Jersey side, nor can they abate a nuisance on our side. The only remedy for this state of facts is by the interposition of some federal law. So, for example, when there are petroleum establishments, and when there are chemical establishments, as there are upon one side or the other of the river, no persuasive influence by New York will reach New Jersey. We want the interposition of some federal power to declare and enforce what is right. This is one of the difficulties that exist there.

The principle feature in our office work is—I am sure the physicians here will appreciate the importance of what I say—to establish a complete record of the vital statistics of the state, and we are doing that, and with good effect. The death of every man is recorded, the time of his dying, and the disease of which he died. It happened about a year ago that one of the courts wanted some important information in regard to the time a man died, and the disease of which the man died. All they had to do was to refer to the state board of health to get the facts. Then we have a complete record of the marriage statistics, and, so far as practicable, the birth statistics. Now there are difficulties attending the performance of these duties, but the state board is endeavoring, and with

comparative success, to secure correct returns, and in the most complete manner.

One word more, and I will take my seat. We find we can do much more, as a general thing, by persuasion than by coercion; and when we have brought the attention of local boards of health, and of boards of supervisors, and, most of all, public opinion, to bear upon these things, we have been able so far, with very few exceptions, to secure what is most desirable for promoting the public health in the towns, villages, and cities of the state.

RHODE ISLAND.

Dr. C. H. Fisher, of Providence, State Registrar, and Secretary of the State Board of Health.—I find myself suffering to-day from a cold, and, because of the accompanying hoarseness, do not know that I shall be able to make myself heard. I will endeavor, however, to give my voice its best possible fulness.

It will not be expected that I shall give in detail the *personnel* of the state board of health of Rhode Island, or its constitution as to its powers and duties as conferred by the act establishing the board. Like that of other boards represented here, the state board of health of Rhode Island has no administrative or mandatory powers in relation to the removal of nuisances. It has very large powers in relation to the restriction of contagious and infectious diseases among domestic animals. As Dr. Chancellor observed, in relation to the powers that be in Maryland, so the legislature of Rhode Island seem to be willing that the state board should have unlimited powers in regard to what they may do to preserve the lives of animals, and but very little, however, in the direction of preserving the health and lives of the citizens of the state.

The board was established in a great measure to unify, or bring under one supervision, several duties that had been previously performed by different officials; that is, for the supervision of the registration of vital statistics, the adoption and execution of measures needed to restrict infectious diseases among animals, and a consulting and advisory body in regard to nuisances. The power given to the board to restrict diseases among cattle and horses,—all domestic animals,—is given by statute. The board is given power thereby to make such rules and regulations as they shall see fit, and those rules and regulations shall supersede all municipal regulations whatever. You see those are very large powers, and we have to exercise them occasionally.

There has been a great deal of sanitary work done in the state for the last eight or ten months,—we will say since the first of March. Since that time more work has been done in the abatement of nuisances in the state of Rhode Island, probably, than in any ten years previous.

The board has endeavored to improve the registration of vital statistics. It has been improved. I do not think there are at this time more than five per cent. of the deaths that occur in the state of Rhode Island that are not returned; I really do not think there are more than three

per cent., but will place it at five, with the remark that there is not a state in the Union where the returns are more complete than in that state.

Now, this meeting and the proceedings have taken a turn different from what I had expected. No particular subject has been discussed. In regard to general hygiene, there has been considerable improvement in the different towns. I follow the general character of the remarks which have been heretofore made. We have a law now which will not permit any child to enter a public school for the first time that does not bring a certificate from a respectable physician, stating that it has been vaccinated, that is, vaccinated to the extent of showing protection from small-pox. That is very generally carried out. That law has been in force some three years. In the city of Providence there has been a municipal regulation or law of the same character for a large number of years. I will say, however, that vaccination has been quite common in the state during the whole period of my thirty-five years residence in the state.

The towns have provided, from time to time, for the vaccination of all persons at the expense of the town. They have also provided that a child moving to a new location, and going to school, must show the teacher of the school in that new location a certificate, showing that vaccination has been performed.

A law was passed by the legislature last winter requiring general hygiene to be taught in the schools. A large number of the teachers in Rhode Island are graduates of the state normal school. In the normal school hygiene is taught. Very much attention is paid to it. It is brought before the pupil in a practical sort of way. By virtue of the law passed last winter, that hygiene shall be taught, it will have a place among the branches taught in the common school.

I must leave out a great many things: I do not want to take up your time. I will say, however, that in regard to the matter of cholera, although the board is, of itself, simply advisory, I have had the assurance of many of the authorities of the different towns in the state that they will be glad to carry out any advice which the board might give, with reference to preventing the introduction or the spread of that disease.

TENNESSEE.

Dr. G. B. Thornton, of Memphis, member of the State Board of Health.—In Tennessee, during the past two years, there have been several epidemics of minor character, such as measles, scarlet fever, diphtheria, typhoid fever, etc. These diseases prevailed mostly in the cities and principal towns of the state, notably in Nashville, Memphis, Knoxville, and Chattanooga, but in no place to such serious extent as to amount to a general epidemic, or to interfere with the business of these places. In the latter part of the summer and fall of 1882, epidemic dysentery prevailed in several localities in West Tennessee, which could not be traced

to local causes, but was attributed to some atmospheric conditions of non-local influences.

An epidemic of typhoid fever occurred in the town of Rugby, Morgan county, an English colony on the Cumberland table lands,—notably one of the most healthful and salubrious sections of the state,—which was attributed, after thorough investigation, to local causes. An interesting account of this epidemic is in the last report of the state board of health.

During the past two years small-pox occurred in the state in a number of places, being introduced from abroad; but it was so restricted and promptly dealt with that it did not spread in any locality to a serious extent. The state board of health, in each instance, took prompt measures in assisting and instructing local boards, where they existed, and where not, county authorities, in preventing the spread of this infection by vaccination, isolation of cases, disinfection, etc. Circulars of instruction were issued, giving specific directions as to the best methods to be adopted. Through the instrumentality of the board of health, a statute, which had become a dead letter, was revived and enforced, which makes it obligatory on the county judge, or chairman of the county court, to provide ways and means for protecting their respective communities from the spread of such infectious diseases. In a number of instances the spread of this, one of the most active and destructive of all diseases, was prevented by state board intervention. The board has assisted local boards in every way it could, by advice through printed circulars, encouragement, visits by its secretary and executive officer, and, when necessary, with what material aid its means would permit. It is invested with no mandatory power in local sanitary affairs;—in this respect it acts only as an advisory body, but is invested with such power by the law creating it in regard to quarantine. Its orders on this subject have the force of law, and their violation, upon conviction before a court of justice, can be punished by as high a fine as $500, and imprisonment in a county jail.

In the administration of an interstate quarantine the board does not assume the right to prevent a public carrier, such as a railroad company or steamboat, from passing through the state; but it can prohibit such carrier from stopping in the state, and its officers or operatives from having any communication with the citizens, or landing freights in the state. For example, if a railroad company or steamboat refuses to submit to inspection and the published rules of the board in regard to an infected place outside of the state, it would be required to pass through the state without stopping.

This board has been in existence about seven years, and while it has had many obstacles in its way, it has accomplished much good work, and has exercised a very salutary influence upon the public health throughout the state. It is ambitious to keep abreast with the most advanced public health organizations in the country. An appropriation of $3,000 per annum is made by the general assembly, to be used in the discretion of

the board for its current expenses. A larger amount will be asked for from the next legislature, to be used as a special quarantine fund, in the event of a threatened or existing epidemic of cholera, yellow fever, or small-pox,—with us the three most dreaded of all infectious diseases.

CANADA.

A MEMBER.—I would now move that we invite the delegates from the dominion of Canada and the provinces of Ontario to explain the workings of their health organizations.

The motion was adopted.

Dr. BRYCE, of Toronto, Canada.—Owing to the short time we have, and inasmuch as a large number of the audience have gone to dinner, I shall say but a few words. I believe we have been able to push our organization forward, in two and a half years, to a state of efficiency quite equal to that of most of the states of the Union. At the last legislature we had a bill passed, with both advisory and mandatory powers, in which all the previous acts have been coälesced. All the boards of the cities and towns report to us, and we have supplied them with all sorts of printed forms for sanitary inspection, and so on. The notification of disease has been made compulsory. Sanitary investigation, with reference to nuisances and outbreaks of disease, has been carried on successfully, and lectures under the superintendence of school boards and mechanics' institutes, and so on, are carried on at all times. We have carried out the system of reporting diseases, and have found it of the greatest value in obtaining information as to epidemics.

Dr. COVERNTON, of Toronto, Canada.—The dominion of Canada has not, strictly speaking, established a board of health, not from a want of appreciation of the importance of it, but simply because the power of education rests with the different provinces. That being the case, they have now a board of agiculture that has attended to the subject of emigration and statistics; and they have been taken as carefully as statistics can be taken. They have attended very carefully to quarantine and to the passage of cattle through our dominion from the various provinces, and to the inspection of the various diseases to which cattle are subject. This board of agriculture had these subjects,—emigration statistics, the investigation of cattle diseases, and quarantine,—under their charge. I may say, sir, that at the meeting we had, the quarterly meeting, last July, I suggested to the members of our board that there was a general impression that the board of Ontario was the dominion board, instead of being really the board only of the provinces of Ontario; and inasmuch as I had then been in receipt of a letter from, I think, Dr. McCormack, the secretary of the Conference of state boards, saying that a very important convention was to be held there on the subject of the best means to be adopted for the prevention of the spread of cholera, I submitted to the board the propriety of putting myself in communication with the Ontario government, which I did, and the result was that they had received no

instructions from Washington; that they were not aware that any such convention was being thought of. Subsequently this postponement was made to St. Louis, and I received a second letter from them. Since that time the board has passed fresh orders in council, having special reference to the most minute attention to subjects coming to Canada from infected parts. As soon as a vessel coming from a suspected port arrives in the gulf of St. Lawrence, it is the duty of the captain of that ship to report the arrival of the ship, under heavy penalty. Then one of the station quarantine officers is sent a distance of one hundred and fifty or one hundred and seventy miles from Quebec, and the vessel inspected. If there is nothing wrong—no sickness, no reason to suspect it from the passengers, either steerage or cabin passengers, their clothing, or from the nature of the case there has been no reason to imagine disease—then the vessel is not subject to detention; but if there is any reason to imagine that there is the slightest danger, the vessel is then detained at the quarantine island, and kept there for three or four days, or for a sufficient length of time for a perfect purification of the ship and for the examination of the passengers' luggage, and if there are any suspected persons, to keep those persons there at the quarantine island so long as the quarantine board may think proper.

The association took a recess until 8:30.

EVENING SESSION, 8:30 *P. M.*

The PRESIDENT.—The association will please come to order. The first paper on the programme for this evening is on "The Food we Eat, and the Adulterations to which we Submit," by Hon. Erastus Brooks, of the state board of health of New York, our second vice-president.

Mr. BROOKS, of West New Brighton, N. Y.—Mr. President, Ladies and Gentlemen: The subject upon which I shall speak to-night, or rather the paper which I shall read, will have the merit of brevity, and I hope the subject, however it may be treated by me, will attract your attention as one of public interest. (See page 222.)

The PRESIDENT.—The next paper on the programme is by Surgeon Walter Wyman, of the United States Marine Hospital Service, on the "Hygiene of Sailors engaged in the Coasting Trade, and especially the Hardships of the Chesapeake Oyster-men." (See page 273.)

THE PRESIDENT.—The next paper on the programme is on "Beer, its Adulterations and their Detection," by Prof. H. B. Cornwall, of Princeton college, N. J. Prof. Cornwall is not here, and presumably the ladies of the audience are not so much interested in beer as in the next subject, so we will pass to that of cremation. "Cremation as a Safeguard against Epidemics," by Rev. John D. Beugless, chaplain U. S. Navy. (See page 140.)

The PRESIDENT.—The next paper on the list is "The Ultimate Sanitation by Fire," by Hon. J. M. Keating, of Memphis, Tenn., editor of the *Memphis Appeal*. He is not here, but Dr. Lindsley has kindly

offered to read it, and then we will listen to some expressions of opinion by members of the association, limiting the time of each member to five minutes, with respect to the interesting and very instructive paper we have heard by Dr. Beugless. (See page 116.)

The President.—I will call upon Dr. Morris, of Baltimore, Md., to open the discussion.

Dr. Morris, of Baltimore, Md.—Mr. President, I can say all I have to say on the subject in less than five minutes. I shall only detain the association long enough to give my own experience in an epidemic, and that experience the manner of burial generally practised in such a time. It was my fortune, sir, to be in Norfolk in the year 1855, to go through that fearful epidemic. At one time we had no coffins in which to place the bodies of the dead, and no one to bury them. In 1855, in September, there were fifty-five bodies in the court-yard of the hospital exposed to the sun. Here was the white and black all heaped together in a mass. When we did bury them, we were compelled to bury them not more than a foot in depth. A friend of mine, Dr. Thompson, of Baltimore, died on the fourth day. I went down there sixteen months afterwards to take back the body to Baltimore. The authorities would not allow me to take it away at the time of the epidemic. When I came to open the grave, a certain fly, called the plague fly, which appeared there for a brief season during the epidemic—out of that grave came a number of those plague flies that had lived there during those sixteen months.

From my experience, sir, I am convinced that there is no means other than fire to be used with safety in case of an epidemic. I have some views about the subject in general, but I have no doubt in my own mind that it is the proper means to use in times of epidemics; and this association would be wise in recommending it for adoption throughout the whole world.

Dr. Formento, of New Orleans, La.—After the most instructive, interesting, and elegant address of Dr. Beugless, there seems to be very little to be added to what he has said. I wish to say a few words as to the effect of the abolishment of air, water, and soil from decomposing bodies. I call to mind the experiment of a learned doctor in regard to yellow fever. He says, in his observations on yellow fever, that he found the ground in which yellow fever patients had been buried, and which had died from yellow fever a year before his experiment, perfectly saturated with some identical microbes that he had found in the living subject. He considers, therefore, that the cemetery is a perpetual focus of disease. And if his experiments are verified, there can be no doubt about the fact that the same will take place with every other contagious disease.

We all know that the germ theory of disease is the one accepted by the scientific world. They have demonstrated that in most diseases of a contagious character there exist living animalculæ as the scientific cause of this disease.

I call to mind the position taken by Dr. Pasteur a few years ago.

Some sheep were put in a pasture-ground where for ten or twelve years previous there had been no sheep pastured. Charbon did not exist at that time in France. A few weeks after the sheep were put in that pasture charbon exhibited itself. It was difficult to account for the spontaneous origin of that disease. He found, after investigating the question, that those sheep died from charbon, and had contracted the disease from sheep that had died and been buried twenty feet in the ground fifteen years before. His explanation as to how those microbes, at the depth of twenty feet, had come to the surface, was, that they came through earth-worms. There is no doubt this is the correct theory, and later or sooner the essential cause of disease will be found to consist in the living animal. Cremation is the only reasonable, the only efficient, the only positive means of destroying those germs; and I cannot see any objection, in any sense, to adopting cremation generally.

I second the proposition made by Dr. Beugless, and I would ask this convention to express a decided opinion, pro or con. I hope it will be received with favor, so that in going through the world with the endorsement of this society, this question of cremation will be generally received, and will be adopted all over the country. (Applause.)

The President.—The resolutions offered to this association have to be referred to the executive committee. You may formulate the resolution and offer it, so that it can be presented to the executive committee.

Dr. Sternberg, U. S. Army.—I am a believer in cremation, and I believe, with Dr. Morris, that during times of epidemic we should burn the dead; but I do not think the reasons which have been given have been satisfactory ones entirely. The reasons which my friend, Dr. Formento, has just given in regard to yellow fever, I certainly cannot accept with entire satisfaction. I know of no evidence that dead bodies of yellow fever patients, after being buried in the ground, have communicated the disease; it is recognized, I think pretty generally, not only by those who have investigated yellow fever personally, but by those who are engaged in similar investigations in Europe, as of no especial value.

I have had under examination bodies of yellow fever patients: I have examined the kidneys, the liver, and the stomach,—the organs generally in which you would expect to find these organisms if they were present,—and it is with yellow fever as it is with cholera, there are no organisms in the tissues. I am not prepared to say that there may not be a germ—indeed I anticipate there is a germ in yellow fever, only it is not in the blood and tissues; and we have no evidence whatever, so far as I know, that bodies of yellow fever patients, after being buried, have communicated the disease to others.

Dr. Bernays, of St. Louis, Mo.—I wish to say a few words in commendation of the excellent suggestion in favor of cremation as the best and only reliable means of destroying germs of disease. In commenting on this, I wish to call attention to the fact that within the last ten years, through investigations made with the microscope, the germ theory of disease has been proved almost to a certainty; that is, that we posi-

tively know that almost all the diseases that are either contagious or infectious depend upon very small organisms for their life and sustenance. We further know that no chemical is able to destroy these germs. Dr. Koch, of Berlin, makes the statement that they can be shown to be capable of multiplication or division; that they have the capacity of infection, even after they have been kept in alcohol (for instance, in alcohol in an anatomical collection) for twenty years. He also makes the statement, that after they have been treated with pure nitrid acid they still have the power of division and of living; and he further proves that the only way of really sterilizing any living or dead matter—sterilizing, making the germs incapable of developing—is to have the temperature above two hundred degrees; above two hundred and fifty, some require.

Now, if we subject the bodies of animals and of human beings that have died with contagious diseases to such a temperature by cremation, we may hope to destroy a certain proportion of the germs that cause this disease. That is a proposition that I think is beyond dispute, that we may destroy by means of cremation a certain proportion of these germs. Whether this destruction of a certain proportion will suffice, if kept up for a number of years, fully to eradicate these diseases entirely and protect the human family from their ravages, is a question that I dare not touch.

We know too little about the origin of these diseases. I have found in the living cell of the watermelon these living bacilli. If you cut a fresh watermelon, slice it very thin, and place it under a microscope of high power, you will see these bacilli. I cannot call them anything else. Now, if these microbes living within a living cell can possibly be the cause of disease, then this cause will exist forever.

Dr. Raymond, of Brooklyn, N. Y.—I would like to be indulged one minute to enter a protest against upsetting the old theories for those of any individual, after so short an experience as we have had with the experiments of Koch. There are schools of methods which have been in use for years, and which have been recommended by some of the best men, the most eminent men; but there seems to be a disposition at the present day to discard entirely the experience of years, in the way of disinfection, when the methods which have been long used are relied upon by the best authority in this country. The disposition is to throw them overboard for theories which perhaps have been utterly disproved.

I feel it my duty to rise and protest. If there is any one thing recognized by sanitarians to-day, it is that we have in sulphur a method of fumigation which does destroy, at any rate it prevents, disease. Any health officer, who has followed up disinfection carefully and systematically, knows as a fact that fumigation is a practical measure. It has resulted in preventing the spread of disease. When small-pox finds its way into a house, when after the case is removed, when the children are vaccinated, when the premises are fumigated, and when vaccinated persons can go into that room and sleep there day after day and night after night and not contract the disease, I think we can justly call those experiments

evidence, carried on to the number of thousands, that we do have in fumigation a method of preventing the spread of disease.

I think we, as scientific men, should be careful about accepting as proven certain reported facts which may be in the course of another year entirely overthrown.

Dr. ROHÉ, of Baltimore, Md.—I want to add my protest to that of Dr. Raymond's. There is no evidence of disease of any sort ever having been communicated from a corpse that has been properly buried—I say properly buried;—and there is no more reason why bodies should not be properly buried through an epidemic, than that they should not be properly burned through an epidemic. I do n't think it would be much easier to burn one hundred bodies a day properly, than it would be to bury one hundred bodies a day properly.

The observation that my friend, Dr. Formento, has referred to, is an isolated one; it stands alone. There is no corroborative evidence, of which I am aware, that after fifteen years' burial in the ground, charbon has been transmitted to other living animals. There is no evidence, that I am aware of, that yellow fever has ever been transmitted from a graveyard. There is no evidence, that I am aware of—and I hope if there is any that any one knows anything of it will be stated—that cholera has been transmitted in the same way, or small-pox, or any infectious disease. That infectious diseases may be communicated from dead bodies before burial is well known, and I think generally accepted; but that any infectious disease has ever been communicated from a corpse after proper burial, and after decomposition has set in and gone on for a certain time, I have no knowledge from my experience or from reading, and if there is any one who has any personal knowledge on the subject I hope it will be stated.

Dr. BAILEY, of Louisville, Ky.—It seems to be in order that this body, or association, must carry with it an idea that I cannot admit; that is, that all the germs of these diseases are contained within the bodies cremated. If the disease generates such germs as may be propagated in others, what will you do with the germs that escape, as in connection with the germs from small-pox, where clothing and other articles may be contaminated? Where will you limit the cremation?

It seems to me that in the case of the sheep, as given by the gentleman from New Orleans, nothing short of the cremation of a ten acre lot would accomplish the purpose. Where shall we stop the cremation? Might we hope to limit the burning until the final burning up of all things? (Laughter.)

Dr. FORMENTO, of New Orleans, La.—There cannot be any doubt that in destroying germs, we do not destroy all the germs. We do what we can do, and that is a good deal. After a body is dead, the only way to prevent that body from becoming an object of danger, not to say anything of the sentimental aspect of the question, is to destroy it, to burn it; to do in a few minutes, in an hour or so, what nature does in a number of years. Decomposition will take place and continue for an indefinite number of years.

Just think of having as many as forty thousand or fifty thousand bodies around a large city, decomposition, more or less advanced, lasting for years and years! It seems to me, by cremating those bodies, we destroy, so far as we can go, those causes of disease. Admitting that the experiments of Dr. Koch are not exactly confirmed by others, leaving them in doubt, we are familiar enough with Pasteur's theory to know that most diseases are caused by those germs, and that some of them have already been demonstrated.

The PRESIDENT.—It is very late, and as to-morrow evening Dr. Sternberg proposes to show some of these germs, I think it would be in order for us to adjourn.

To-morrow evening I most cordially invite you to attend Dr. Sternberg's exposition of disease germs, when he will illustrate by a calcium light some very remarkable things which have never been shown in this country before.

The association adjourned, to meet to-morrow at 9 A. M.

THIRD DAY.

THURSDAY, October 16, 1884.

MORNING SESSION.

The association assembled at 9 o'clock, the president in the chair.

The PRESIDENT.—The association will please come to order. The first thing in order will be the announcements of the Committee on Arrangements by the secretary.

Dr. HOMAN, of St. Louis, Secretary of the Committee.—The Committee of Arrangements request all those who desire to visit the parks to-morrow afternoon to leave their names with the treasurer, in order to know how many carriages to provide.

The PRESIDENT.—Next will be the announcement of the Executive Committee.

The SECRETARY, Dr. Watson, presented a list of names for membership.

It was moved that the gentlemen whose names were presented be elected to membership in the association.

The motion was adopted.

The PRESIDENT.—Is there any miscellaneous business now to come before the association?

Dr. HUNT, of Metuchen, N. J.—I desire to offer this resolution:

Resolved, That the association hereby expresses its pleasure at the prospective meeting of the International Medical Congress in this country in 1887.

It seems to me it would be very well for us to express our approval—our pleasure at the prospective meeting.

The PRESIDENT.—Under the rules it goes to the Executive Committee.

Dr. REED, of Mansfield, Ohio.—Mr. President, I move you that the

Committee on School Hygiene be instructed to formulate a practical system of school hygiene, and report the same at the next meeting of this association.

The PRESIDENT.—The resolution goes to the Executive Committee.

The PRESIDENT.—The report of the Auditing Committee on the treasurer's report can now be offered.

Dr. DEVRON, of New Orleans, La.—The secretary has it, sir.

The SECRETARY.—I have the treasurer's report, but I do not find the report of the auditing committee.

The PRESIDENT.—There is some delay in the programmes this morning, although they were so anxious to expedite it they got the proofs away from me before I could correct them. The programme as published in the morning papers is correct; but our regular programme is incorrect in that Dr. Davenport's paper has not been substituted for Dr. Abbott's in the evening session. Instead of Dr. Abbott's paper it should be Dr. Davenport's. I regret that the mistake has occurred.

The first paper in order is the report of the Committee on Cattle Disease, by J. M. Partridge, M. D., of the state board of health of Indiana.

Dr. HUNT.—I happen to be on that committee. I think Dr. Partridge intends making a report. I hope it will be passed at present.

The PRESIDENT—I am very sorry that the members are not punctual. The programme has been prepared with a great deal of care, and to pass over papers displaces everything. Perhaps it will not be irregular for Dr. Conery, of the state board of health of Missouri, to read his paper on "Sanitary Care in Stock Transportation." (See page 282.)

Dr. HERRICK, of New Orleans, La., offered the following resolution:

WHEREAS, There may be an opportunity to represent to the people of the country, through the World's Exposition at New Orleans, such facts as it may be serviceable for them to know in relation to public health and sanitation,—

Resolved, That a committee be appointed to confer with the management of the New Orleans Exposition relative to an exhibit in the interests of public health, and, if it seems to them desirable, to supervise the preparation of such exhibit.

The PRESIDENT.—The resolution goes, under the rules, to the Executive Committee.

The PRESIDENT.—As we have interrupted the programme, if there is any other resolution to be offered, this will be a convenient time to offer it.

Dr. COVERNTON, of Toronto, Canada, read an address, elsewhere given.

The report of the Auditing Committee was read by the secretary and adopted.

The PRESIDENT.—Next in order is the report of the Committee on Cattle Disease, by J. M. Partridge, M. D., of the state board of health of Indiana. (See "Report of Committees.")

A MEMBER.—I think this report is a very important one, or at least the committee is an important one, and ought to be continued. We are realizing more and more, in the state which I represent, that these dis-

eases are a great trouble to us. We have had this year Texas fever, swine plague, pleuro-pneumonia, and hog cholera, to a considerable extent, imported into the state, which so much affect the food-supply of the country; and the diseases of animals are so similar in character, and there is so much to be learned about them, that it is certainly very important that we should continue this subject for our consideration. I merely, sir, desire to make the suggestion that the name of the committee be changed to a Committee on Animal Diseases and Animal Foods, and be continued in that form.

The PRESIDENT.—The question is now on accepting the report.

On motion, the report was adopted.

The PRESIDENT.—Now the motion is in order.

A MEMBER.—I merely make that as a suggestion for the Executive Committee.

The PRESIDENT.—The Executive Committee had already concluded not to continue the committee.

A MEMBER.—I make the motion, that the proposition for its continuance as a Committee on Animal Diseases and Animal Foods be referred to the Executive Committee.

The motion was adopted.

The PRESIDENT.—The next paper is by Dr. Bell of New York,—the report of the Committee on Management of Epidemics. (See Reports of Committees.)

Dr. Holt, of New Orleans, president of the state board of health of Louisiana, here read a paper, a part of the report of the Committee on Epidemics, and then spoke as follows:

The history of a vessel up to the time of entering the mouth of the Mississippi river, the time which elapses from that time up to the time she actually leaves quarantine,—all this will determine the action in each particular case. If there is in process of incubation any disease, say yellow fever, the probabilities are great that it will have made its appearance by the time the vessel will be ready to take its flight to the city.

Again: When a captain of a vessel and the officers on board are allowed to come to the city, they are kept under surveillance all the time; they are at no time lost sight of;—whereas, when a number of emigrants or a number of sailors are thrown loose upon our levee, and make their way into the very lowest dens and boarding-houses, and disease develops in such a case, the probabilities are, the first we would know of the man would be his being brought to the charity hospital. We lose sight of all these people the very instant they touch our shore; but all these, however, during quarantine, are kept at the quarantine station, and held there during the allotted period of time.

Second, as to the treatment of the cargo. As soon as all those who have come have been conveyed from or have left the vessel, an acclimated crew of stevedores go aboard, the hatches are opened, and all the work of bringing out the cargo, of washing, disinfection, and fumigation, is

accomplished by these acclimated people, and no risk is run of infecting one of those brought on board of the ship by allowing him to go down into the hold of the vessel, striking instances of which have occurred in our city.

As for the time of the detention of the ship, that will be determined by the character of the cargo. For instance, the time that it takes to unload a vessel with thirty thousand sacks of coffee is certainly very much greater than in the case of a bark with a cargo of lumber: the time to attend to that vessel will be greater, according to the nature of the cargo and the difficulty of handling, or the necessity of breaking it in order to get at it to bring about a sufficient and thorough disinfection and fumigation. These questions will all determine the length of the detention of the vessel in quarantine. I may briefly say, that it will vary between eighteen hours and three days.

Now, take the instance of a coffee vessel, arriving with a large cargo of coffee. The consignees do not wait all this time for their coffee to come up to the city, but it is rapidly unloaded into closed barges. The barge having been filled, it is securely closed, and sulphurous acid fumes are driven up into it until it is absolutely filled. In this manner it comes up to the city, the process of fumigation and disinfection going on all the time. In the case of a cargo of lumber, when the cargo itself is already damaged, it is not necessary to break that cargo or distribute it at all. It is simply necessary to wash and cleanse it, and then batten its hatches in a manner I will describe in a few minutes.

Now, gentlemen, as to the sanitation of the ship. The first that is done to the ship itself is to wash it thoroughly. Gentlemen, here are some photograph miniatures of the plans. I wish you would distribute them. They are numbered in such a manner that they can be designated at once.

Now, gentlemen, our quarantine station is provided with a powerful vessel. There is a tug to take it to the lower quarantine station, or bring it up from the lower quarantine station to the upper. On board this tug is a force-pump, such as is used for fires by the harbor fire vessels. It is capable of throwing an enormous stream of water by steam-power. Then there is provided and placed on the deck of this vessel a disinfecting apparatus, which consists of a battery of furnaces. These furnaces consist of refractory clay tubes ten inches in diameter and four and a half feet long. There are none of them in the battery, as you see there. We insure by this means the very highest saturation of a given volume of air with sulphurous acid. The tubes enter into a chest so as to resist the power of the sulphurous acid. The chest is five feet wide and four feet long. This is simply an exhaust chest. Connected with this exhaust chest are an indraft tube and this powerful rotary fan. That is just the same as those now used in our large elevators and planing-mills. It is a curiosity to see the draught of air that is driven out by one of those rotary fans in full motion. The revolutions of that fan are from fifteen to eighteen hundred a minute. The outlet is twenty-two inches by fourteen.

The air passing at the highest velocity, you can imagine what a quantity of air loaded with sulphurous acid is thrown from that through the hose down into the very lowest part and into the structure of the vessel. The vessel is then first washed out by a hose passing from the force-pump down into this vessel: she is washed out thoroughly from stem to stern. Then the hose is removed, and this disinfecting tube is put in its place and the sulphurous acid forced in. The vessel has been closely battened, with the exception of an open hatchway at the farthest extremity from the point at which you are doing this, and the machinery is kept going until the vessel is filled from its bottom up in that manner under the tremendous draft and powerful pressure. The sulphurous acid is driven in in this manner until the vessel is absolutely filled up, and the sulphurous fumes begin to overflow at the top, which indicates that she is absolutely full of this sulphurous acid gas. Then the hatchway is fastened, and the vessel allowed to rest for a period of six or eight hours.

Now, gentlemen, after that searching wash by steam-power machinery, after driving under tremendous force that sulphurous acid into every corner of that vessel in which atmospheric air can possibly penetrate, if there is any truth in sanitation, if there is any truth in our power of destroying low forms by germicidal agents, I cannot, for the life of me, fail to see wherein that vessel has not been thoroughly cleaned; and if there had existed in that vessel any germs deleterious to health, those germs must have been annihilated under the concentrated influence of the sulphurous acid. We are not limited as to the particular kind of gas that can be thrown through that. We can use any kind that may be desired.

Gentlemen, I will not impose upon your patience by a further description of this. I will only make one statement, for the sake of Dr. Bell. You will observe that the board of health has adopted for the port of New Orleans, in the place of carbolic acid, which has utterly failed for all these years past, bi-chloride of mercury. It has adopted it for these reasons: In the first place, carbolic acid is offensive and injurious on the decks of those vessels during the long and hot July sun. It is expensive, and, so far as the effect is concerned, it has disappointed us in New Orleans woefully. On the other hand, bi-chloride of mercury has been proven to be the most thorough, or the most powerful, germicidal agent of all chemicals known. It is absolutely odorless. It is absolutely without blame as to any consequence, inconvenience, or harmfulness to those who have to deal with it. It is absolutely without anything that, after solution, would enable you to tell it from simple rain-water. We sprinkle it in all those parts that have been inhabited by the sailors, if it is needed. We dip clothing into it, and let it dry; and there is not the slightest danger of any harm's coming to any one who has to deal with it.

The President.—I am somewhat embarrassed to know how to act as to the matter of time for the Committee on Epidemics. You see our programme, and the committee have already consumed fifty minutes. Shall I continue the time?

A Member.—It is very obvious that there is more work provided in

this programme than can be performed between now and half-past two o'clock. I think the judgment of the president will have to be exercised with regard to limiting these papers and the discussions upon them.

A MEMBER.—I should like to move, Mr. Chairman, that this committee be allowed to proceed at least with a summary of the general conclusion arrived at. It is very interesting.

The PRESIDENT.—If that is the decision, I will give the committee ten minutes more, which will make an hour.

Dr. BELL, of New York.—I have reports contributed by associates of mine in public institutions,—the lying-in hospital and infant asylum,—in New York, where epidemics of the severest character have occurred,—measles, whooping-cough, and other diseases,—and where an epidemic of puerperal fever occurred in another branch of the same institution. They are described in detail by the visiting physician in charge. This, I suppose, will go without being read.

I think it may be stated, however, with respect to the same general principles that Dr. Holt has so well described in regard to absolute disinfection, cleansing of the sick, and separation from the well, that the most complete results were had of stamping out in a short period of time those several epidemics; and at the lying-in hospital particularly, the bichloride of mercury was used to the exclusion of almost every other means for the time being. That was used intermediately every day or two, giving a thorough disinfection by means of sulphur fumes.

I have here some notes in regard to this, and they are devoted to one subject which is interesting. Wherever these means are watchfully and energetically applied, we have confidence in their efficacy. We have in this brief report brought out, as it were, the important fact, that about one fourth, or a little more than one fourth, of the total mortality of the United States is caused by the ordinary epidemics of diphtheria, intermittent fever, measles, whooping-cough, and scarlet fever; that of a little less than eight hundred thousand deaths, two hundred thousand of them died from those diseases which we consider preventable by the same measures applied to those described in this report, and by the same means as can be made applicable to ships in quarantine for cholera and the like.

The PRESIDENT.—I will say now that Col. Waring is not here, but that he has sent his paper to be read by title. It is on "The Disposal of Sewage."

The next paper to be read is on "The Sanitation of the Mississippi Valley," by G. B. Thornton, M. D., of Memphis, president of the state board of health of Tennessee. (See page 214.)

Dr. ROHÉ, of Baltimore.—I have listened with a great deal of pleasure to the paper of Dr. Thornton. For several years it has been my lot to be along the Mississippi river, and I duly appreciate the truth of what he says with regard to sanitation in that region. I think, generally speaking, too little attention has been paid to it. The thanks of the association are due to the doctor for calling attention to that important region.

The PRESIDENT.—The next paper on the programme is entitled "The

Present and Future of Water Analysis," by Major Charles Smart, surgeon U. S. A., member of the National Board of Health. (See page 79.)

The President.—It is not intended to omit the feature of discussion this morning, but it has been thought better to read the papers first, and then to have a discussion afterwards, particularly on the question of the management of epidemics, and so on, as suggested by the papers of Drs. Holt and Thornton. Hence I hope the members will remain, in order to take part in the discussion.

The next paper is on "The Pollution of the Upper Ohio, and the Water-Supply of its Cities and Towns," by J. E. Reeves, M. D., secretary of the state board of health of West Virginia, first vice-president of the association.

Dr. Reeves.—I have the honor to make the following report on the sanitary survey of the Ohio river, from its origin at Pittsburgh to the city of Bellaire, or the first hundred miles of its course, hoping some gentleman will commence at the point at which I shall leave off, and continue the survey until the Gulf of Mexico is reached. (See page 86.)

The President.—I am desired by Dr. McCormack to state that there will be no meeting of the Conference of the state boards of health this afternoon, as some have understood. They have adjourned to meet in Washington in December.

I am also requested to state that the advisory council will meet this afternoon. It is very important that all members of the advisory council shall be there at 3:30. The list of the members is placarded at the entrance of the room.

Dr. Herrick, of Cleveland, Ohio.—I rise to a point of usage, custom, or order. Papers are presented here for the approval of this society: they are published as approved by this society. There is no opportunity given for discussion, or for expressions of approval or disapproval, as the sentiments of the association, contrary to the design and usage of this society. Those papers presented here are not the society's property, yet whatever papers we do hear and act upon, and approve and publish, we are to a certain degree responsible for. Therefore I think there is injustice in having this society approve papers and publish them without giving an opportunity for discussion.

The President.—We have classified the papers, and had the discussions of the papers as they have been classified. Have you been at the previous meetings of the association?

Dr. Herrick.—I have.

The President.—You must be aware that we have had discussions at the end of the several series of papers. I am proposing now to get through with the programme as quickly as possible, when we will have a discussion.

Dr. Herrick.—Well, the papers and the different points pass from the minds of the gentlemen, and they are unable to discuss intelligently those very papers.

A Member.—There is one point which I think is not understood.

Instead of everything that goes out from this society without a disclaimer being assumed to be the sentiment of this society, it is exactly the other way. Everything that goes out from this society is really understood to be the sentiment of the individual who prepares it, without the endorsement of the society.

The PRESIDENT.—Yes, sir.

Dr. HERRICK.—As the sanction of the society for or against an expression is reported with a transaction, it goes to show the society is recognizing its various directions and teachings.

The PRESIDENT.—Every paper is examined carefully by the Executive Committee before it is published. This year we have had to read the papers as offered, but the intention is to have every one of them carefully examined. That is a constitutional provision. It is the duty of the Executive Committee to do that, but it has been absolutely impossible to examine all of them in advance, as some of these papers were not received in time. Some of them came in this morning. Very few of the papers were received until Monday, and it is absolutely impossible for us to effect a more satisfactory arrangement.

The next paper is on "The Relation of Depth of Water in Wells to the Causation of Typhoid Fever," by Henry B. Baker, M. D., secretary of the state board of health of Michigan. (See page 184.)

The next paper on the programme is entitled "The True Value of Chemical Analysis in Determining the Hygienic Purity of Potable Water," by Thad. M. Stevens, M. D., of Indianapolis, Ind. (See page 96.)

Dr. HUNT, of New Jersey.—I wish to read a brief proposition:

A sub-committee of the Executive Committee of the American Public Health Association, consisting of Messrs. Reeves, Devron, and Gatch, met at Liederkranz hall, October 15, 1884, at 11 o'clock A. M., to hear plans of Henry Lomb, Esq., of Rochester, N. Y., as to prizes in relation to investigations bearing on public health. Mr. Lomb had made known his plans to Dr. Reeves, of West Virginia, and had requested him to bring them before the Executive Committee of the Association. He also requested that Dr. Sternberg, U. S. A., Dr. Hubbard of Indiana, and Dr. Hunt of New Jersey, should meet with this committee.

Mr. Lomb made a statement as to his plans, and offered to give prizes for the next year to the amount of two thousand dollars.

Mr. Lomb proposed the following subjects for prizes, which were universally approved by the committee:

1. Healthy Homes and Foods for the Working Classes.
2. On the Sanitary Conditions and Necessities of School-houses and School-life.
3. Disinfection and Individual Prophylaxis against Infectious Diseases.
4. The Preventable Causes of Disease, Injury, and Death in American Manufactories and Workshops, and the best Means and Appliances for Preventing and Avoiding them.

Mr. Lomb accepted the plan.

It was moved and seconded, at the suggestion of Mr. Lomb, that the essays on Disinfectants and Individual Prophylaxis should be ready by April 1, 1885, and those on the other subjects by December 1, 1885.

At the suggestion of Mr. Lomb, it was resolved that the prize go to the author, and the essay to the association.

Mr. Lomb also offered, in addition, to head a subscription list with fifty dollars to aid the committee, under the resolutions of the association as to disinfectants.

Resolved, That one in each committee of five, to be appointed hereafter to receive the essays and to award the prizes, be appointed by the National Board of Health, three by the Executive Committee of the American Public Health Association, and one by the president of the Conference of State Boards of Health, and that the same person shall not be on any two committees.

Resolved, That these minutes be presented at once to the association.

E. M. HUNT,
Secretary of the Sub-Committee.

The PRESIDENT.—You have heard the proposition, which is very generous on the part of Captain Lomb.

Dr. REEVES.—I have a word to say, and I say it because Captain Lomb is not here. He is known in the community where he lives as a very charitable man. Every noble or charitable undertaking in the city of Rochester first seeks his patronage; and I am here to say that I have it from the mouths of the citizens of Rochester that he never fails to make his contribution when he is asked to do so. The first time he met this association he had not been in the house a day's session until he came to me and said, "I see what you want. You have an abundance of light, but your light must be hidden under a bushel because you have no means to disseminate it. I propose to assist you, if it is acceptable." This committee was appointed, and you see the result.

The proposition was adopted unanimously by a rising vote.

The PRESIDENT.—I hope you will not fail to observe that he has also given fifty dollars to contribute in aid of this committee. I do not want to say anything more *in extenso:* we will refer to it to-morrow. We were anxious to get it before the association, and therefore encroached a little upon our time. To-morrow morning, when it is reported by the Executive Committee, it will be considered as it deserves to be.

The next paper is on "The Manufacture of Soda Water from Polluted Well Water," by Frank R. Fry, M. D., of St. Louis Medical College. (See page 332.)

The PRESIDENT.—The next paper on the programme is on "The Disposal of Sewage by Chemical Action and Subsoil Irrigation," by George N. Bell, C. E., of Newport, R. I.

The PRESIDENT.—The next paper on the programme is on "The Relation between Underground Sewerage and Filth Diseases," by S. S. Herrick, M. D., secretary of the state board of health of Louisiana. (See page 180.)

The PRESIDENT.—The next paper is on "The Chemical Disposition of Sewage," by W. John Harris, M. D., of St. Louis, Mo. (See page 266.)

Dr. HARRIS.—Mr. President and Gentlemen: I think, in order to save time to this association, instead of reading this paper I can in a few words give you the substance of it, and in that way it will be more readily discussed, and save probably fifteen minutes anyway. From the papers that have been already presented there can be no doubt, I think, of the advisability and the necessity of some disposition of sewage previous to turning it into the rivers. I mean by that, that the rivers are

undoubtedly polluted by letting the sewage flow into them as it is generally done now. That has already been demonstrated in the papers that have been read to you.

This subject was very much impressed upon my mind as long ago as 1864 and 1865. I was then a school-boy in the city of London. The river Thames had become so foul from the amount of sewage that was turned into it, that it was very unpleasant to cross any of the bridges. At that time the sewage system of that great city emptied into the river at frequent intervals through sewers. As you will perhaps recollect, in the year 1865 there was a great cholera epidemic, and so offensive had this river become at that time that it was necessary to cast into the river thousands of barrels of quick-lime to render it to some extent possible for the inhabitants to cross the bridges.

Five years ago, when I was there, I took a great deal of interest in looking up this matter, and I found then that the system of sewerage had been entirely changed by the city of London. It was conducted through two immense sewers, one on the south side and one on the north side of the river, to thirteen miles and a half below the city, where it was turned in at the ebb of the tide just in its natural state. Then there are two immense reservoirs located thirteen miles and a half down the river, one on each side, and this immense quantity of sewage is brought down there with a fall of about two feet to the mile, so that the whole of the sewage has to be lifted up twenty-six and a half feet in one case, and twenty-seven in the other, to the height of the reservoirs. I mention this simply because it has been stated—I don't know that it has here, I have not heard all the papers—but it has been stated by a great many sanitarians that sewage will purify itself in three or four miles. Well, I carefully examined the water in the river Thames at Westminster bridge, fourteen miles above where the sewage was turned in, and there was undoubted evidence of sewage. Many times you could find the crude article; and one of the engineers, the sanitary engineer there, told me he could find at any time large quantities of it all along the river banks—which, I think, goes to prove that sewage can be washed backwards and forwards for a long time without perfect disinfection.

In our rivers here, some of them, like the Mississippi, where the current is very swift and there is a great deal of sand in the river, the effect is different—the immediate effect is different. So I don't think there can be any doubt of the necessity of doing something with this sewage previous to turning it into the rivers. Irrigation has been set up as the proper means to dispose of sewage. Well, that is true. There is no doubt mother earth is the proper disinfectant; but you must remember, where you have a large city, that the population is altogether out of proportion to the area that is occupied, and for that reason if you convey the sewage in a large city on to the soil, even if it is quite a number of miles off, you will find that the absorbing power of the soil is self-limited. Of course with a clay soil it very much sooner becomes saturated, but even with a sandy soil that is self-limited. So I think irrigation, even, is self-limited.

Now the question comes up to me, and a great many others, How can you dispose of the sewage with success,—that is, to treat the sewage in such a way that you can convey the water to the sea, and the sewage to the soil, which should be done? Well, there have been a great number of plans advocated. As you all know, I suppose, there is the process whereby sewage is treated with alum; then there is the A B C process, that is, the alum, blood, and clay process. The refuse is treated with sulphuric acid. That process was used in some of the towns in England, but is a very expensive plan, and it has not met with very good results either. A superintendent at one place told me that at first the stock went up immensely, because they thought they could manufacture manure and sell it to the farmers, and make an immense profit; but the results proved that the cost was about twenty dollars a ton for the manufacture of it, and they realized about two dollars and a half to three dollars a ton for the sale of it, so that in a very short time the company became bankrupt.

The process that seems to me most feasible is the one now in use at Windsor. That is managed in this way: The chemicals that are used are a cubic yard of quick-lime, one hundred weight and a half of chloride of magnesia, and four gallons of coal tar. They are used to disinfect one and a half million gallons of sewage. The process is this: The sewage is pumped up as it comes along in the sewer into what is called a mixing-trough, which is about three feet wide, three feet deep, and four hundred and fifty feet long. As the sewage is pumped up, these chemicals are mixed with it. The lime is first of all slacked in a separate tub, and then the chloride of magnesia and the coal tar are added in a steady stream. They run together through this mixing-trough. At every two feet of this trough are boards set half way across, one here, another there, and another there, so the force of the sewage coming against these cross-boards thoroughly mixes it. Then the water, sewage, and chemicals flow through this trough into what is called a settling-basin, which is twenty-five feet long, and about five feet deep at one end and seven at the other. It flows in over the deep end, the bottom of which is about that angle [indicating], and flows out of the shallow end, so the slanting bottom acts as a retainer, and the solid portion is consequently settling here, and the liquid portion, or the water, goes over here [indicating]. It goes from one tank to another one, and from there it is conveyed into the river, so that no solid matter goes into the river, but only the affluent water. That is in operation three or four days. At the end of that time it is turned into another tank, and the residue is pumped out of this tank that has been used three or four days, and when it has become dry the farmers come and haul it off and use it on their farms. Now, that is the most practical plan that I saw there, and is really the cheapest; and I think it is the most feasible that I know of, giving the water to the sea and the sewage to the earth.

The PRESIDENT.—The next paper on the programme is on "The Disposal of Sewage," by Col. George E. Waring, C. E., of Newport, R. I.,

secretary of the National Board of Health. He was not able to come here. At the last moment he wrote me he would not be able to keep his engagement, consequently I read his paper by title. (See page 176.)

We can now proceed to the discussion of some of these papers. We have three quarters of an hour.

Dr. HUNT, of New Jersey.—I desire to make only a few remarks in regard to the last paper read in regard to the disposal of sewage in streams. There are some streams, there are some kinds of soil, and there are some localities in which it is quite possible to dispose of the sewage into streams. There are many others in which it is not possible so to do consistent with the public health. We have nothing to say in favor of the Clyde. It is bad, and getting worse continually, and we had no relief until some of the land-owners below sued the city for damages. The same thing existed at Belfast, and there the question of the pollution of the stream again came before us in a certain position. Now, the proposition of the gentleman, or the works to which he alludes, have some advantages. The great trouble is, that there is such an immense amount of stuff that it will not dry. I allude to this because there are at present in England much better works than these. Within the last two years, at Coventry, in England, and at two or three other points, it seems to me they have reached a solution with regard to this slush. By the Waldering (?) process they are able to compress this slush. It is not claimed it has any great value as a manure, only selling it at two and sixpence, three and sixpence, three and eightpence being the highest. They have been able so thoroughly and effectually to reduce the quantity of it that they are able to get clear of it. I have seen what seems to me to be the solution of the problem. Coventry has within one year bought works, after having consulted two of the most distinguished engineers of England, on the basis of this new machinery. This Waldering (?) process seems to accomplish the result. I think the greatest advancement made in the handling of sewage has been made within the last two years. This so impressed the London committee, that, after sitting two years, in which the cost was two hundred and fifty thousand dollars, for the taking of testimony and the trying of methods, they have advised this method to be adopted by London itself. Although that adoption has failed, because it has not the influence of the landholders, it is believed, by those who have investigated the subject thoroughly, that his method, the Waldering (?) process, reduces the slush to a condition in which it can be utilized and sold at a very low price, and that it is the best advancement in regard to handling sewage made within the last quarter of a century.

Dr. HARRIS.—I want to say to the gentleman that I was not aware that had been adopted. That was since I was there. I am very glad to hear it is. The engineer was at that time making an experiment there in that way. They were at that time using or trying to sprinkle ashes or something of that kind on it in damp weather. You see the trouble there is, the climate is much more damp than it is here. Anything of

that kind dries more slowly. Whether the slush can be sold at a profit or not is not the question under discussion here. I do not think that whether it can be made profitable or not is the matter we are looking at.

Dr. Raymond, of Brooklyn, N. Y.—There was one point brought out in the paper with reference to well-water, that is, with reference to the difficulty of pronouncing water in a well good or bad. It occurred to me that the experience which we have had in Brooklyn with reference to this matter might be useful to other members here. We found that as a matter of fact well-water in the same well varied very remarkably, so that while to-day a specimen from a given well would be entirely free from any contaminating quality, yet in a week's time that same water would be condemned by any one. It occurred to me in hearing the paper read to-day, by Dr. Smart, I think, in which he called attention to the fact that different chemists would pronounce differently upon specimens of water from the same well, and that water which was considered to be harmless by one would by another be pronounced injurious and contaminating, might be due to that fact. It is a well known fact, that the condition of these surface wells varies not only at different periods of the year, but at different periods of the same season. So it is absolutely essential, in order to pass on its harmfulness, to test it at various times throughout the year.

Another point brought forward here to-day was in reference to the contaminating influence of well-water in soda water. There is nothing by which the carbonic acid gas will purify the water. If the water itself is impure, the effect on the soda water must be harmful.

There is another point recently brought out,—not that the soda water is liable to impurity from contaminating influences from well-water, but from the poisonous vessels in which it is stored, and the tubes or faucets from which it is drawn. We have had recently in Brooklyn an investigation into that subject, and we found, as a result, that copper cylinders and copper fountains were in use, and that brass tubes were permitted to run the syrups and soda water to the faucets, which were also of brass, or lined with brass. This has been our experience there: In something like twenty-five analyses, we have found copper in seventeen out of twenty-five, which explains, I think, the experience of almost every one, that soda water frequently makes people sick. While I think attention has been properly drawn to the use of impure well-water, I think attention should still more be drawn to the inorganic poisons which are liable to be taken up by the acid syrups. You would be surprised to see the amount of green material taken up by the acid. The unfortunate individual who rises early in the morning is very much like the early bird —"the early bird catches the worm"—he is very apt to catch this green material containing inorganic matter.

If there is one thing upon which this association should place its foot, and do so by resolution if necessary, it is the use of pump-water in cities of any size. I am very glad to hear the statements made to-day, that the attention of the authorities here is being called to that matter.

We had in the city of Brooklyn, two years ago, three hundred and sixteen wells. These wells were located upon public streets, and we had abundant evidence, not only from analyses of chemists, but from an examination of the surroundings, that those wells could not but be contaminated,—some of them four or five feet from public sewers, some of them within that distance, with drains which were found to be leaking; and, with the exception of something like eight or ten out of the three hundred and sixteen wells, they were all found, upon chemical analysis, to be impure. Some of them the chemists described as worse than London sewage; some of them were absolutely offensive to the smell.

It was a very difficult thing to persuade our common council, and even the public, that this water that they had been in the habit of drinking was injurious. It so happened, about the time we commenced to make this examination, that a number of cases of sickness occurred. In one family there were four cases of malignant dysentery, resulting in two deaths. The evidence was so plain and uncontradictory that every one was satisfied that the well had something to do with those cases. And I would say, for the benefit of those gentlemen who feel there is no use in attempting to control public opinion, that it was only by keeping the thing up week after week and year after year that finally we have succeeded in closing all those wells but five; and of those, three were not closed because the water was not, upon analysis, found to be impure.

Now there is only one other thing I would like to refer to here, and that is the paper of Dr. Herrick. The inference from that paper, I think, would be an erroneous one, were it not that we are apt to confound the dangers from public sewers with the pipes of the house itself. The term sewer gas is misleading. This gas outside of the house is injurious, but my experience leads me to believe that we suffer a great deal more from gas from the pipes within the house. If an examination of the houses in this city were made, I am satisfied it would be found that diphtheria is largely due, not to the filth in the sewer outside, but to the gas arising from decomposing material within the pipes of the houses.

Dr. Bryce, of Toronto, Canada.—Mr. President and Gentlemen: There have been to me three or four papers this morning of extreme interest and value; not only those with reference to the disposal of sewage, but especially those with reference to the analysis of water, and Dr. Baker's paper. The remarks made by the last speaker, are, I am sure, agreed to by all.

It was only, I think, within a year of the lamented death of Professor Smith, that he told us that the analysis of water had a new future before it; that the chemical analysis of water was very imperfect; and that the recent microscopic examination of it through culture experiments had, even in his unpractised hands, gone so far as to cause him to believe that that was the future to which we must look if we are to expect anything practical in the way of water analysis.

The fact stated by the last speaker concerning the constant changing of water must be perfectly apparent, when we think of the decomposing influences which are constantly going on in inorganic matter.

Without referring to the other papers, I would speak of Dr. Baker's paper, and compliment him and the association on such a valuable addition to the papers we have had read. I only refer to it in this way, however, from the fact that I think possibly we may be led away by Dr. Baker's paper from some others that have an equal importance and interest. He has referred, and I have no doubt with perfect truth, to the fact that as the ground is drained less, typhoid fever increases. But I think we shall see that that is not the only factor which gives rise to typhoid fever at that particular season of the year, and if the doctor will excuse me I shall use his own figures as an illustration of what I mean. Looking at the tables for 1879 and 1882, I find in those two years, as in all the other years, that typhoid fever has gone on in its upward course in the month of July or August, and whether the water rose, or fell, it has invariably kept rising up to the month of October or November. Now, if you will look at the tables, gentlemen, in the year 1879, you will see that the water began to rise in the month of August, and kept continually rising until November; or, in other words, the amount of soil above it decreased. In the same year you will also see that typhoid fever increased up to November. That is the first point, probably, which the doctor noticed; and I would refer to 1882 for the same fact. We have the water rising again from July onward until the month of September, and typhoid fever constantly rising again. Here we have a constant law with reference to the rise of typhoid fever from August until November, or October at any rate.

Now, the point I wish to make is, not that the doctor's statement is not true with respect to the rise and fall of water, but that there are other elements entering into the causation of typhoid fever which these tables do not explain; and I would refer to the report in Canada for the year 1881 for an explanation of it. We carry on a system of reporting or receiving reports weekly of diseases, yet I think all will agree that the reports we get concerning typhoid fever are to be taken with considerable allowance. We know of many medical men who are in the habit of calling everything typhoid fever, which more properly would be called remittent fever or typhoid malarial fever.

Now in a dry soil, such as we had in 1881, it means necessarily a large amount of organic decomposition on the surface; and the carrying of that in the air, especially along the water-courses where the water bottoms are low, is another means or element explaining in that year the unusual amount of fever, especially in that city where I was. In that city, to show it was not typhoid fever, I think there were only four or five deaths that season from that fever. So we have organic matter in another form quite as important, which means surface sanitation as well as the cleansing of the subsoil water.

Dr. Herrick, of Cleveland, O.—I desire to say a few words with regard to sewage, that being the last paper that came before this association. I have been engaged in the instruction of medical students in Cleveland for the last few years; and I have found, in my inquiries and studies,

very much difficulty in explaining the methods of sewerage as consistent with the object desired. You are well aware of the methods adopted for sewerage here by means of distinct surface sewers. These seem to be entirely futile in accomplishing the object. It has occurred to me, and I ask the question, whether we are, after all, in the right road or direction for meeting this question of sewerage; whether we are going to disinfect the great mass of sewage matter, or whether it is going to be used as an irrigating agent, or whether it is to be disposed of by means of fire—by means of burning. It all arises from individual foresight or location whether, after all, we may not better look to fire as the agent for disposing of this substance and preventing its effect upon the community, —in the cities particularly.

The sewage we have to contend with is the *débris* from the table, the kitchen, and the offal from privy vaults. Now, it is practically impossible to dispose of this in our ordinary methods. But it has occurred to me, and I have broached the question to those whom I have met, whether, after all, we cannot better look to the disposal of this material by means of fire, and consume it in the various avenues where fire is required in our cities, in manufactories, and in our own homes. I simply ask that question.

Now, with regard to the paper of Prof. Smart. I had some inquiries in my own mind at the time it was read, which I regard as valuable, as suggestive ones to me, with regard to infecting material or waste. And this was the question I should have asked at that time, and I have the pleasure of asking it now. He makes the positive statement that the bacteria are to be regarded as the infectious material in water, and I ask him if it is so accepted; whether, after all, it is not the disorganized material of the animal in the water which is the infecting agent. If the vital processes have commenced in the animalcule, is he to be regarded as the agent of infection? I ask this question more particularly for information.

Dr. Smart.—The question goes further than I am prepared to enter into at the present time.

Dr. Herrick.—I simply asked that question, if I may be allowed to state, because I understood the doctor to make the positive declaration; and it occurred to me, after all, that it was the decomposing organized matter which was to be regarded as the infecting agent, rather than the bacterial forms of growth.

Dr. Vaughan, of Ann Arbor, Mich.—I would like to say just a few words to show my high appreciation of Dr. Smart's paper, and to emphasize a few statements that he made. I think that it cannot be denied, from what we have already learned, that one computation to determine the amount of organic matter in water is no criterion as to whether that water is harmful or harmless. In emphasizing some of the statements that Dr. Smart made, I wish to say that no chemist can possibly assert, at present, from analysis, that water is certain by any means to produce disease. He can only say that a certain water is suspicious, and that is all he can say.

Now, one thing further I desire to say. Dr. Smart recommends that we follow the biological method in our future study of water and analysis. I would say we should follow the biological and the chemical combined. Most of us believe that typhoid fever, in many cases, is produced by impure water. Then let us begin the study in this way: Let us take the water and put it in culture, and cultivate the bacteria or the bacilli, or whatever else may be involved in it, and study them so we can know them accurately. If we can find any sure means by which ordinary mortals can with the ordinary microscope decide as to the presence or absence of certain characters of bacteria, or if we can find any positive tests that certain products produce by themselves living bacteria, then this water analysis will be something that is possible, and never until that is done.

Dr. Fee, of Kansas City, Mo.—We live in a practical world, and we shall always be governed, in regard to this matter of sewage, by the appropriations made by the city councils and state legislatures. All these cities on the Missouri and Mississippi rivers will probably make use of water carriage, and the disposal of the sewage will depend altogether on the dollars and cents.

Now, with regard to the paper of the gentleman from New Orleans. I believe all evidence goes to show that any city—it does not make any difference what city it is—that has a system of sewers is more healthy for it; that there is less typhoid fever where a city is properly sewered, and where the sewers are properly ventilated: I think that is the evidence of all writers. I think it is conclusively shown, that any city that has a system of sewers—stone water sewers—when they are properly ventilated, and the house-drains are properly put in, is freer from all kinds of disease in consequence. Now, in Kansas City we have less typhoid fever and we have less diphtheria in those parts of the city that are sewered, than in those parts that are not sewered.

Mr. Robert Moore, C. E., of St. Louis, Mo.—I would like to ask how Dr. Herrick would cremate the liquid refuse, which is, after all, the most injurious.

Dr. Herrick.—It was simply a suggestion. It possibly occurs to you, as to all, that, after all, this sewage we are disposing of is integral. I propose that every household should provide for the disposal of its own sewage, as well as the table offal, by combustion. That, perhaps, is impracticable, but it seems to me that the excrement may be consumed in some way. At the sewer openings the water is terribly foul, and it is impossible to think of disinfecting it or using it for irrigation. My suggestion is, to go to the fountain-head and see what there is in that. I simply suggest the idea.

The President.—Has any other member anything to say?

Mr. Moore.—Mr. President, I just wish to say a word in regard to the paper read by Dr. Thornton, of Memphis. He mentioned the reclaiming of this low land district, a part of which embodies a system of reservoirs, on the idea of using the river as a means of controlling great

floods; but our engineers will not endorse that remedy, for that particular reason, as a class. I think the reservoirs are very much like controlling the floods of the sea with brooms: they are perfectly useless. And I might also say, that the controlling of the Mississippi river by levees is one about the propriety of which men differ very seriously indeed. Some who have given the subject the greatest attention, think that if it be practicable to control the floods of the Mississippi river by a levee system, you will by that system destroy the navigation of the river. I do not myself affirm the opinion positively, but, as I say, it is the opinion of some who have given the matter very great study.

Dr. Reed, of Mansfield, O.—There is one point we have apparently all overlooked, in this sewage question, and that is, What shall be done with the sewage of inland cities? Now, it has been presumed by all the papers, apparently, that we have a method of disposing of sewage by water. You speak of large cities on the lakes or on the ocean. Now, what are we who live in inland cities, not on any body of water, going to do with our sewage? It is becoming a serious question. It has been agitated in our own city, and in a number of other cities in Ohio. We cannot empty it into a little creek passing by the town, if we are going to be sued by the farmers all the way down for contaminating the water. Can we make use of it on the farms? The experiment at Pullman, Illinois, seems to have been abandoned for some reason, whether it was from the want of being a success or not. If that is a failure, what are we going to do with it? We must do something with it. We have got it, and we are like the boy with the white elephant: he has got it, and he has got to do something with it. We have to find some way by which to dispose of it. We cannot use the cesspools any longer: they are contaminating our city with their offensive odors. This thing has to be attended to in some way. It is a question that ought to be looked into as well as the sewerage in larger cities. In fact, it takes in a large population, who are suffering to-day from the effects of this sewage contamination in the smaller cities in the innermost parts of our states.

The association took a recess until 8 A. M.

EVENING SESSION.

The president called the association to order, and asked Major George M. Sternberg, Surgeon U. S. Army, to read his paper on "Disease Germs." (See page 69.)

Dr. Sternberg.—Mr. President, Ladies, and Gentlemen: I see by the report made in the morning papers that a few remarks which I made last evening, in a discussion, were misunderstood by the reporters. One newspaper announces that Dr. Sternberg does not believe in germs. Now, many of the members of this association know that I have been a germ hunter for many years, and that I do believe in germs, and that I believe in disease germs, and I shall present evidence to you to-night that there are disease germs; but I do not believe that every tyro who

has professed to discover disease germs is right, and I do not swallow all the statements that come to us from across the water, even. I shall show you, also, that there are many organisms, of the same class as those disease germs, which are harmless, and surround us on all sides. And while I dwell upon the variety of these harmless organisms, pray do not understand me to say that there are no disease germs.

It is but a few years since disease germs were hypothetical things, in regard to the nature, origin, formation, and modus operandi of which we based only vague and uncertain notions.

Dr. Sternberg's paper was illustrated by numerous photo-micrographs and chromo-lithographs, showing the germs in consumption and splenic cases. He gave details of his investigations in Havana in regard to yellow fever. He stated that he had been unable to find the germ of yellow fever, and doubted if it was to be found in the blood of the patient.

The PRESIDENT.—The next paper on the programme is on "The Bearing of the Discovery of the Tubercle Bacillus on the Public Health," by L. Bremer, M. D., of St. Louis, Mo.

Dr. BREMER.—Mr. President, Ladies, and Gentlemen: You have heard the excellent paper of Dr. Sternberg, and have seen projected on the screen the specific germs about the effects of which I am going to speak. I do not support all the assertions put forth by the doctor;—but this is no place to discuss these questions. I must say that I am a firm believer in the doctrines of Koch, and that I subscribe, from my own observations, to everything he has said and written about tubercle bacillus.

The PRESIDENT.—The next paper on the programme is by Dr. Davenport: I understand he prefers to read it to-morrow morning.

The last paper on the programme is on "The Hygiene of the Mind and Nervous System," by Charles H. Hughes, M. D., of St. Louis. Dr. Hughes says, in consequence of the lateness of the hour, he prefers to read his paper by title only.

The association adjourned, to meet Friday morning at 9 o'clock.

FOURTH DAY.

FRIDAY, October 17, 1884.

MORNING SESSION.

The association reassembled at 9 o'clock, the president in the chair.

The PRESIDENT.—The first business is the announcements from the Committee of Arrangements.

Dr. SPIEGELHALTER, of St. Louis, Chairman of the Committee.—The carriages for this afternoon's excursion will he at the Southern hotel at half-past one o'clock. We want to start as early as possible, by two o'clock, if we can, so as to get in the nicest part of the day. The carriages will return to town in time for the trains. I shall see to that, so nobody need stay back on account of his intention to leave town. We

shall return by seven o'clock, and that will leave plenty of time for nearly all the trains.

A MEMBER.—My train leaves at seven o'clock.

Dr. SPIEGELHALTER.—Well, we will have to return earlier.

A MEMBER.—Yes; by six o'clock.

Dr. SPIEGELHALTER.—All right, then. At nine o'clock this evening we are invited to a reception at the Elks Club rooms, at the corner of Sixth and Walnut streets, over the theatre entrance. For to-morrow there is no programme fixed. I would like to ascertain the number of gentlemen who intend to stay over, so as to make up some sort of a programme. The number is too small to make a steamboat excursion. We might accept the invitation of Mr. Cook, to visit his wine cellar, if that will suit the gentlemen. It will be a good way to wind up; and we might take a drive to the fair grounds and other parts of the city that we are not able to see to-day. We shall be glad if those gentlemen who intend to stay over to-morrow will be kind enough to leave their names at the treasurer's office.

We start from the Fourth-street entrance of the Southern hotel to-day. In order not to spoil the fun for the balance of the members, those who want to leave early this evening can say so, and go together in carriages, and those carriages can leave Mr. Shaw's place earlier than the rest of them.

A MEMBER.—That is a very good arrangement.

The PRESIDENT.—You have heard the report of the Committee on Arrangements. The next business is the announcements from the Executive Committee. Now, gentlemen, pay attention to this: there are several resolutions to be reported.

The SECRETARY.—Mr. President, the following resolution is adopted and recommended by the Executive Committee:

Resolved, That a committee be appointed to confer with the management of the New Orleans Exposition relative to an exhibit in the interests of public health, and, if it seems to them desirable, to supervise the preparation of such exhibit.

The SECRETARY.—The Executive Committee have adopted this resolution, and recommend that the Advisory Council constitute such committee.

The resolution as follows was then, on motion, adopted by the association:

Resolved, That the Advisory Council be instructed to act as a committee in connection with the New Orleans Exposition, and that each member of the committee, in his own state, or the department which he represents, shall do all that is contemplated by the resolution to secure a proper hygienic exhibition at the New Orleans Exposition.

The SECRETARY.—I have this resolution to report from the Executive Committee:

Resolved, That this association considers cremation as the essential sanitary measure in all cities and crowded communities, especially in times of epidemics.

The SECRETARY.—The Executive Committee recommend that this resolution be not passed, but that a committee be appointed to investigate the subject of cremation, and report at the next meeting of the association.

The PRESIDENT.—I would suggest that it be called by a more general term—On the disposal of the dead.

A MEMBER.—That is better: it covers the whole subject, and the other only a single branch of it. I will offer that as an amendment.

Dr. ROHÉ, of Baltimore.—Is it intended only to cover that, or is it intended to cover the disposal of refuse by fire, as was considerably discussed?

The PRESIDENT.—The resolution does not contemplate that. You can amend it, if you please.

Rev. Mr. BEUGLESS, of Brooklyn, N. Y.—The objection to the amendment would seem to lie in the fact suggested by the member just taking his seat—that the scope of the resolution becomes invalid thereby. Cremation ought to take in all dead matter that is to be disposed of in any way, and that may become a source of infection.

Dr. HIBBERD, of Richmond, Ind.—Mr. Chairman, the matter of the disposal of refuse matter of other kinds is so widely separated from that which belongs to the disposition of human bodies that are dead, that it seems to me in every way pertinent that they should be considered as separate subjects.

The PRESIDENT.—The motion now is, that a committee be appointed to report upon the subject of the disposal of the dead. Of course, it is understood that cremation is a matter to be considered in connection with it.

Rev. Mr. BEUGLESS.—I earnestly hope that resolution will not be adopted in that form. It certainly comes within the scope of any cremating company, and any organization that seeks sanitary reform in this way, to cremate all dead matter just as much as to cremate the dead human body.

The PRESIDENT.—You can move that as an amendment, if you wish, Mr. Beugless.

Rev. Mr. BEUGLESS.—I move that the amendment be amended so as to include all kinds of dead, offensive matter.

A MEMBER.—I second the motion.

The PRESIDENT.—There is another reason why we should call special attention to the disposal of the dead: If the whole subject of the disposal of the waste-matter is brought in, we, as well as the public, will lose sight, in our report, of the main issue in question. Therefore I earnestly hope the original amendment will prevail. The question now is on the amendment of Mr. Beugless, to make this investigation include the disposal of all refuse matter. Understand, you are voting only on the question to extend the scope of this investigation to the disposal of all refuse matter.

The motion was lost.

The President.—Now we come to the first amendment, which was to make this investigation extend to the disposal of the dead, not limiting it to the subject of cremation. The amendment is, to make this investigation include all methods of disposing of the dead.

The motion was carried.

The President.—Now the question is upon constituting a committee to investigate the subject of the disposal of the dead, to report at the next meeting.

The motion was adopted.

The President.—How many shall the committee consist of?

A Member.—Five.

The President.—If there is no objection, I will make the number five. I will name the committee in a few minutes.

The Secretary.—The Executive Committee recommend the following special committees: first, a Committee on State Boards of Health; second, a Committee on Incorporation; third, a Committee on the Investigation of Disinfectants. They also recommend the abolition of all other existing special committees.

Dr. Rohé.—If I recollect, yesterday there was permission given for still another committee—the Committee on the Relation between Diseases of Animals and Animal Food.

The President.—This resolution of the Executive Committee is intended to do away with that.

A Member.—I do not understand, Mr. Chairman, that this resolution, if adopted, will prevent the subsequent appointment of the special committees.

The President.—No, sir. Perhaps it had better be put this way: The Executive Committee recommends the appointment of three special committees, one on state boards of health, one on disinfectants, and one on incorporation.

A Member.—I move that the recommendation be changed to four: that will include the committee already agreed upon this morning.

The motion was adopted.

A Member.—What is the fourth one?

The President.—On the disposal of the dead.

A Member.—We have already established a committee of that kind.

The President.—It is only to change the phraseology of the report, making four instead of three.

A Member.—I do not think you can change the recommendation of the Executive Committee. I move the recommendation of the committee be approved just as it stands.

Dr. Raymond, of Brooklyn, N. Y.—It seems to me we are proceeding in a very irregular manner. When a committee has already been appointed, if I am not mistaken, it will be necessary for us to reconsider the action. Inasmuch as that has been established at a regular meeting, if I am not mistaken, it will be entirely irregular without reconsideration.

The President.—It is a curious state of affairs. The Executive Committee's entire report ought to have been read before action was taken on any part of it.

Mr. Lomb, of Rochester, N. Y.—There is a good way to get around this. It would be to move that the report of the Executive Committee be laid upon the table, and then move that each one of these special committees be established.

A Member.—I withdraw my motion to approve the recommendation. I move this report limiting the number of special committees to three be laid upon the table.

The motion was adopted.

The President.—Now the Executive Committee contemplates recommending the creation of a special committee on state boards of health.

A Member.—I move such a committee be appointed.

The motion was adopted.

The President.—I appoint the following gentlemen as members of that committee:

Dr. G. P. Conn, President State Board or Health, Concord, N. H.
Hon. Erastus Brooks, Member State Board of Health, Richmond, N. Y.
Dr. J. T. Reeve, Secretary State Board of Health, Appleton, Wis.
Dr. Joseph Holt, President State Board of Health, New Orleans, La.
[1] Dr. J. G. Thomas, President State Board of Health, Savannah, Ga.
Dr. G. B. Thornton, Member State Board of Health, Memphis, Tenn.
Dr. C. N. Hewitt, Secretary State Board of Health, Red Wing, Minn.
[1] Dr. F. W. Hatch, Secretary State Board of Health, Sacramento, Cal.
Dr. Peter H. Bryce, Secretary Prov. Board of Health, Toronto, Ont.

A Member.—I move there be a Committee on Incorporation appointed as recommended by the Executive Committee.

The motion was carried.

The president appointed the following named gentlemen to serve on the committee:

Dr. James E. Reeves, President, Wheeling, W. Va.
Dr. Irving A. Watson, Secretary, Concord, N. H.
Dr. J. Berrien Lindsley, Treasurer, Nashville, Tenn.
[2] Medical Director Albert L. Gihon, U. S. N., Washington, D. C.
Major Charles Smart, U. S. A., Washington, D. C.
Hon. John Eaton, Washington, D. C.
Dr. Smith Townsend, Washington, D. C.
Major Samuel A. Robinson, Washington, D. C.

The Secretary.—As our present president has done a great deal of work in securing the incorporation of this association, and understands in detail the progress that has been made, I move that he be added to that committee.

The motion was adopted.

The following resolution was adopted:

[1] Deceased.
[2] Added by vote of the association.

Resolved, That a committee of seven be hereby constituted to examine the subject of disinfectants, and their relations to preventive medicine and sanitation, and that said committee formulate a table of these agents for the information of those interested, the agents to be classified, so far as may be deemed advisable, according to their specific virtues, facility of application, and economy of use.

The president appointed the following persons to constitute the Committee on Disinfectants:

Dr. GEORGE M. STERNBERG, U. S. A., Baltimore, Md.
Dr. GEORGE H. ROHE, Baltimore, Md.
Dr. CHARLES SMART, U. S. A., Washington, D. C.
Dr. JOSEPH H. RAYMOND, Brooklyn, N. Y.
Dr. V. C. VAUGHAN, Ann Arbor, Mich.
Dr. W. H. WATKINS, New Orleans, La.
Prof. ALBERT R. LEEDS, Hoboken, N. J.

The association adopted the following resolution recommended by the Executive Committee:

Resolved, That the American Public Health Association fully appreciates the active interest and support of its members in St. Louis, and that its thanks are hereby tendered,—

To Dr. Joseph Spiegelhalter, chairman, Dr. Geo. Homan, secretary, and the members of the local Committee of Arrangements, for their earnest work, which has so largely contributed to make this, its twelfth annual meeting, one of the most successful in its history;

To the Hon W. L. Ewing, mayor of the city of St. Louis; His Excellency Thomas T. Crittenden, governor of Missouri; Hon. George W. Parker, president city council, chairman Reception Committee; Mr. Elliot, Jr.; Dr. E. C. Gregory, president state board of health, Mo.,—for their interest in the objects of the association, for their warm welcome and able addresses which inaugurated the meeting in this city;

To the St. Louis and Laclede Gas Light Companies, Messrs. Mandsley and Mepham, and Mr. Socrates Newman, for the fairy-like scene which the streets of the city presented on one of the evenings of the meeting;

To the press of the city, and particularly to the *St. Louis Globe*, *Democrat*, and *Republican*, for the full and accurate reports of its proceedings which appeared in their columns;

To the Western Union Telegraph Company for favors received; and

To Henry Shaw, Esq., the Elk Club, Isaac Cook, Esq., the Mercantile Club, the University Club, the St. Louis Club, the Germania Club, the Liederkranz Society, Prof. Woodward of the Manual Training School, Prof. Ives of the Art Museum, Samuel E. Brown, Esq., the Public School Library, the Mercantile Library, the Fair Grounds Association, and the Board of Public Schools, for courtesies extended.

Dr. SPIEGELHALTER.—I would like to ask if we have passed beyond the arrangement of the business and the adoption of the recommendation of the Executive Committee as to disinfectants and the disposal of the dead.

The PRESIDENT.—That has already been passed, and the committee appointed.

Dr. SPIEGELHALTER.—Is it allowable to have another committee appointed?

The PRESIDENT.—I will call for other resolutions as soon as we get through with the reports of the Executive Committee. This is all formal work of that committee we are considering now: after that, we can consider what we please.

Rev. Mr. Beugless.—I thought this committee on the disposal of the dead came under the recommendation of the Executive Committee.

The President.—That committee was established long ago.

Rev. Mr. Beugless.—I beg pardon: I misunderstood.

The Secretary.—The Executive Committee recommend the following changes in the constitution:

Article III. Omit last sentence of first paragraph, to wit, "All members shall be elected as follows," and substitute following additional paragraph:

Delegates from national and state boards of health, and all organized sanitary associations and municipal boards of health, and from the army, navy, and marine hospital service, shall be entitled to be enrolled as active members upon presentation of their credentials to the Executive Committee.

Members not delegates from such bodies shall be elected as follows:

The present second paragraph to follow immediately after the above.

Article VIII to be entitled Standing Committees instead of Committee, and to read as follows:

There shall be the following standing committees: 1. The Executive Committee. 2. The Advisory Council. 3. The Committee on Publication.

The present second paragraph to be made Article XIV as farther on.

Article IX. The following additional paragraphs to be introduced:

The Executive Committee shall consist of the president, first vice-president, second vice-president, secretary, and treasurer, of six active members elected annually by ballot, and of the ex-presidents of the association.

The paragraph defining the duty of the Executive Committee to become the third paragraph of the new article.

Article X to be entitled Advisory Council, and to read as follows:

The Advisory Council shall consist of one member from each state, territory, or district, and from the army, navy, and marine hospital service, bureau of education, and from the dominion of Canada, who shall be appointed by the president on the last day of each session, and who, besides acting as a nominating committee of officers for the ensuing year, to be announced at such time as the Executive Committee may appoint, shall consider such questions and make such recommendations to the association as shall best secure the objects of the association. They shall at their first meeting elect from their own number a secretary, whose record of their proceedings shall be made part of the records of the association.

Article XI to be entitled Committee on Publication, and to read as follows:

The Committee on Publication shall consist of the secretary and two active members, selected by the Executive Committee, who shall contract for, arrange, and publish, under authority of the Executive Committee, the proceedings of the association, including such papers as have been examined and approved by the Executive Committee, or which have been submitted to them by the latter for their discretionary action.

Article XII to be entitled Reports and Papers, and to read as follows:

All committees and all members preparing scientific reports or papers to be laid before the association at its annual meeting, must give, in writing, the title of such reports or papers, the time to be occupied in reading them, and an abstract of their contents, to the Executive Committee, at least one week preceding the date of such meeting, to secure their announcement in the order of business.

Article X to be Article XIII; Article XI to be Article XIV; Article XII to be Article XV; Article XIII to be Article XVI.

Dr. Bell, of New York city.—The first recommendation I would like to amend, so far as also to include delegates from voluntary sanitary associations.

The President.—That can be considered next year. Has the Executive Committee any further communication to make?

The Secretary.—They propose a list of names for membership. (Which the secretary read.)

On motion, they were elected.

Dr. Bell.—I would propose this in addition: All delegates from all sanitary associations and municipal boards of health.

The President.—That will lie over until next year.

Dr. G. P. Conn, of Concord, N. H.—I do not remember to have heard the name of the honorable governor of Missouri proposed for membership. If it be in order, I would like to propose him as an associate member of our society.

The President.—It requires the unanimous consent of the association.

Dr. Bell.—Does that constitute him an active, associate, or an honorary member?

The President.—An associate.

Dr. Bell.—Very well; we will all give him a send-off. I move that the Hon. Thomas Crittenden be elected a member associate of this association.

The motion was adopted.

The Secretary.—The following are the subjects for competition in the Lomb prizes: No. 1, "Healthy Homes and Foods for the Working Classes;" No. 2, "The Sanitary Conditions and Necessities of School-houses and School-life;" No. 3, "Disinfectants and Individual Prophylaxis against Infectious Diseases;" No. 4, "The Preventable Causes of Disease, Injury, and Death in American Manufactories and Workshops, and the best Means and Appliances for Preventing and Avoiding them."

A Member.—May I inquire when the essays are to be submitted?

The President.—April 1st.

A Member.—Mr. Lomb tells me that he desires the essay relating to disinfectants to be submitted the 1st of April, but he is willing to extend the time for the others until our next meeting. I think that will be decidedly better: it will draw out better papers. I move it be so stated on the minutes.

The motion was adopted.[1]

A Member.—Is there any way provided by which these offers of prizes shall be announced immediately to the public? Have the Executive Committee made any provision for that, or Mr. Lomb, or anybody else?

The Secretary.—The Executive Committee have made suitable provisions.

Mr. Bell.—I want to know how all the world, or those who wish to compete for those prizes, will be advised of this?

The President.—It will be the duty of the secretary to publish that.

[1] At a meeting of the Executive Committee, in December, it was agreed that all the essays should be submitted to the secretary on or before October 15, 1885.—I. A. W.

I believe he has been very expeditious hitherto in such matters, and I have no doubt that he will issue circulars at once.

Dr. STERNBERG.—I move, when these committees are appointed by the proper authorities named by Mr. Lomb, that the secretary of the American Public Health Association publish a list of the prizes in at least three medical journals and in two sanitary journals in this country, and in "*Science*." Those will make six journals, which will give it wide circulation.

The motion was adopted.

The PRESIDENT.—The next business in order is the announcement of the Advisory Council. Dr. Rohé, the secretary of the council, is here.

Dr. ROHÉ.—The proceedings of the Advisory Council, held October 11th, are as follows:

ST. LOUIS, MO., Oct. 16, 1884.

The advisory council was called to order by President Gihon at 3:30 P. M.

On motion, Dr. Rohé was elected secretary.

The roll was called, and the following answered to their names:

Dr. C. A. Lindsley of Connecticut, Dr. J. H. Rauch of Illinois, Dr. T. M. Stevens of Indiana, Dr. Bailey of Kentucky, Dr. S. S. Herrick of Louisiana, Dr. George H. Rohé of Maryland, Dr. H. B. Baker of Michigan, Dr. D. W. Hand of Minnesota, Dr. A. N. Bell of New York, Mr. Crosby Gray of Pennsylvania, Dr. George B. Thornton of Tennessee, Dr. Harris of West Virginia, Dr. Conery of Missouri, Dr. E. M. Hunt of New Jersey, Dr. H. B. Horlbeck of South Carolina, Dr. C. H. Fisher of Rhode Island, Dr. R. H. Reed of Ohio, Dr. Swearingen of Texas, Dr. S. H. Durgin of Massachusetts, Dr. J. T. Reeve of Wisconsin, Dr. Smith Townshend of District of Columbia, Dr. George M. Sternberg of U. S. A., Dr. A. L. Gihon of U. S. N., Dr. Armstrong of U. S. M. H. Service, Dr. G. P. Conn of New Hampshire.

Dr. Rauch stated that it was the desire of the Hon. John Eaton, commissioner of education, to have an exhibit of sanitary appliances at the World's Exposition in New Orleans. After some discussion, it was voted to refer the matter to the Executive Committee for such action as seemed to that committee necessary or desirable.

A communication was read from Dr. Charles Wm. Covernton and Dr. P. H. Bryce of Canada, extending an invitation to the association from the dominion government and the Ontario board of health to hold the next meeting at Toronto. Also a communication from the commissioners of the District of Columbia inviting the association to hold its next annual meeting in the city of Washington.

The council proceeded to the nomination of officers, and nominated the following, whom they recommend to the association for election to the various offices specified:

President—Dr. James E. Reeves, of West Virginia.

First Vice-President—Hon. Erastus Brooks, of New York.

Second Vice-President—Dr. H. B. Baker, of Michigan.

Treasurer—Dr. J. Berrien Lindsley, of Tennessee.

Executive Committee—Dr. H. P. Walcott of Massachusetts, Dr. Charles Smart of U. S. Army, Dr. George B. Thornton of Tennessee, Dr. D. W. Hand of Minnesota, Dr. Gustavus Devron of Louisiana, Dr. H. B. Horlbeck of South Carolina.

The council recommends that the next annual meeting of the association be held in the city of Washington, D. C., December, 1885. The council also recommends that the thanks of the association be extended to the government of the dominion of Canada and the Ontario board of health for their kind invitation to hold the next meeting in Toronto, and that the secretary be instructed to decline the invitation.

On motion of the council, adjourned *sine die*.

GEORGE H. ROHÉ,
Secretary Advisory Council.

The report of the Advisory Council was accepted.

The PRESIDENT.—You have now before you the recommendation of the Advisory Council as to nominations of officers of the association. We will proceed now to elect officers for the next year.

A MEMBER.—I move that the secretary of the association cast the ballot for the nominees of the Advisory Council to be officers of the association for its next year.

The motion was adopted.

The SECRETARY.—I deposit the names which were read as the nominees for officers for the ensuing year.

The PRESIDENT.—The association has elected for its officers for the following year: (See Officers and Committees.)

I have the pleasure of presenting to you the president-elect. I need not say anything in eulogy of him. He was present at the birth of this association, and I am sure he will be in with it at its death, if that should ever happen.

Dr. J. E. REEVES, of West Virginia.—Gentlemen of the Association: I am very sensible indeed of your good opinion, and I thank you with a grateful heart for having clothed me with the highest honors it is possible to give a sanitary worker in the United States.

The association has come to me with bright prospects indeed, brighter, I think, than ever before in its history, and I shall be very energetic in order to continue these prospects, and turn over to my successor the association in as good condition as it is at present. Soon we shall cut loose from St. Louis, where we have had a pleasant and profitable meeting. I know, gentlemen, you will all join me heartily in the wish that as we sail for the capitol at Washington we may have a pleasant breeze and a profitable voyage. I thank you, gentlemen, again—in the name of West Virginia, I thank you.

The following resolution from the Executive Committee was read:

Resolved, That this association considers cremation as an essential sanitary measure in all cities and crowded communities, especially in time of epidemics.

The Executive Committee recommend that the resolution be not passed, but that a committee of five be appointed to investigate the subject of cremation, and report at the next meeting of the association.

Adopted.

The PRESIDENT.—I will now appoint the Committee on the Disposal of the Dead. I am somewhat hampered by the number. If the association would extend the number to seven I might perhaps make a more satisfactory committee.

A MEMBER.—I move that seven be appointed.

The motion was adopted.

The PRESIDENT.—I will name as the committee the following gentlemen:

DR. JOHN MORRIS, Baltimore, Md.
Rev. JOHN D. BEUGLESS, U. S. N., Brooklyn, N. Y.
Dr. FELIX FORMENTO, New Orleans, La.

Dr. A. N. Bell, New York City.
Dr. William Bailey, Louisville, Ky.
Dr. James F. Hibberd, Richmond, Ind.
Dr. James A. Keller, Hot Springs, Ark.

The President.—As there is no more general business before the association, first in order is the report of the Committee on Museum of Hygiene, by Henry P. Walcott, M. D., member of the State Board of Health, Lunacy, and Charities of Massachusetts. (See "Reports of Committees.")

The President.—The next is the report of the Committee on Vital Statistics, by Lieut. Col. John S. Billings, surgeon U. S. Army, chairman. He is not here, and he will probably make his report in writing.

The President.—The next paper is the report of delegates to the International Congress of Hygiene at the Hague, by Capt. Alfred C. Girard, surgeon U. S. Army. Dr. Girard is not here. It would consume a good deal of time to have the report read. I suggest it be read by title only, and passed.

The President.—The next paper is "The Duration of Infectiousness of Scarlet Fever," by W. W. Vinnedge, M. D., of the State Board of Health of Indiana. (See page 287.)

Dr. Vinnedge.—Mr. Chairman, with your permission, and with the permission of the association, I would like to change my title from the one you have just read to that of "A Plea for a More Prolonged Isolation and Disinfection in the Management of Scarlet Fever."

The President.—We have a paper here from W. C. Cook, M. D., of Nashville, Tenn., "On Public Health and Legislation." It is too late to be read, and will be submitted to the Executive Committee. (See page 269.)

The President.—The next is a series of papers on "A Survey of the Present Hygienic Situation in St. Louis." The first of the series is by Col. Henry Flad, C. E., president Board of Public Improvments.

The President.—The second of the series is on the "Organization of Health Department, Sanitary Legislation, and the Abatement of Nuisances," by John D. Stevenson, Esq., health commissioner. (See page 305.)

The President.—The next paper is on the "Sources, Quality, etc., of the Milk and Meat Supplies of St. Louis," by Joseph Spiegelhalter, M. D., member board of health, and J. C. Cabanné, Esq. (See page 320.)

The President.—Dr. Rohé has a resolution to offer from the Advisory Council relative to the late Dr. Elisha Harris. (See resolutions elsewhere.)

Dr. Bell.—Mr. Chairman and Gentlemen of the Association: It is with some emotion, I assure you, that I have heard this tribute to an associate in the sanitary work, which commenced at about the date of this tribute. In 1855, while Dr. Harris was physician in chief of the "marine hospital," it should be called,—there was no such name then as quarantine hospital at the port of New York,—I became acquainted with

him and his work. But in 1856, as co-workers, if I may be permitted to name myself with him, we were both actively engaged in the prevention and spread of yellow fever from Fort Hamilton and Bay Ridge, which had been condemned by the quarantine as it was then conducted, the anchorage ground being then in the Narrows, and of the most improved character. The people became greatly excited, to such an extent that soon afterwards the hospital, of which Dr. Harris was physician in chief, was destroyed, so incensed were the people at the spread of the disease from the quarantine establishment as it was then conducted. We worked together for about two months, I might say, night and day, and established the hospital at Fort Hamilton for the reception of yellow fever cases taken all along Sandy Ridge, called Bay Ridge, extending eight miles from Fort Hamilton to Brooklyn, quite up to the paved streets, taking down also at this hospital such cases as were assigned to it. We did much more. We investigated the various places, where we found that many cases of yellow fever had been sent to both New York and Brooklyn, tracing the dunnage of persons even after they had been overtaken and sent back to be detained at the quarantine station and hospitals.

Now, to skip a space and say nothing more about what we did together at that time, in which we also had the assistance of a man whose name will always be identified with those times, not only for his works, but in the history of Brooklyn, the late Mayor Hall—

The PRESIDENT.—I shall have to limit you. The time is short.

Dr. BELL.—I will cut my remarks short, but I regret we have not more opportunity to go over this work of Dr. Harris's. I would like to take time to make one correction in the minutes. Dr. Harris did not have to do with the creation of the present system of quarantine, further than that he served on the same committee in the old National and Quarantine Convention, from which the present law was deduced several years later.

Dr. BAKER.—I wish to say one word. I want to rise to support these resolutions, and I think we are indebted to Dr. Rohé for so justly paying this tribute to Dr. Harris, and I think we ought to testify our respect in the most emphatic manner. I would suggest that those resolutions be adopted by a rising vote. I make that as a motion.

The motion was adopted.

Dr. NEWTON.—I will interrupt the proceedings one minute to offer the following resolution, with reference to forming a Society of Analysts and Chemists.

The following was offered by Dr. Wm. K. Newton, of New Jersey:

WHEREAS, It has been contemplated to form a society similar to the Society of Public Analysts of England, and composed of those engaged in food and other sanitary analysis in this country; and

WHEREAS, It is thought that associations are already too numerous in the United States, and it is considered that more good work may be done by working in connection with this association;—therefore,

Resolved, That the constitution be so amended as to provide for a section or committee on sanitary analysis, to which may be referred papers and essays on food, water, and other sanitary analysis.

The PRESIDENT.—Do you offer that as an amendment to the constitution?

Dr. NEWTON.—Yes, sir.

The PRESIDENT.—It lays over till the following year.

Dr. ROHÉ.—The council presents the following resolution, and respectfully requests favorable action thereon:

Resolved, That the Executive Committee be requested to make a sufficient appropriation to cover the necessary expenses incurred in their researches.

The PRESIDENT.—That can only be considered by unanimous consent. Otherwise it will have to go to the Executive Committee. Is there any objection to considering that resolution? There is no objection, so Dr. Rohé will please read it again.

The resolution was again read, and adopted.

The PRESIDENT.—The next papers on the programme are on "Street Paving" and "The Public Water-Supply," by Thomas J. Whitman, water commissioner, and J. W. Turner, street commissioner. These gentlemen request that these papers be read by title, and they are so read. (See pages 315, 318.)

The next paper is on "The Average Temperatures and Prevailing Climatic Conditions of St. Louis," by Prof. F. E. Nipher, Washington University. (See page 302.)

Inadvertently I passed the name of Mr. Cabanné. Mr. Cabanné has his own paper, and I now call him.

The next paper is on "Public Sewerage and House Drainage," by Robert Moore, C. E. I have another paper, a very valuable one, which I will read at the same time, "On the History of Cholera in St. Louis," by Robert Moore, Civil Engineer.

Mr. MOORE, of St. Louis, Mo.—I have no doubt but that the audience would thank me for saving them from the infliction of reading these papers at this time, and I will allow both papers to be read by title.

The PRESIDENT.—I regret Mr. Moore's making that request, because his papers are very valuable ones, and he has taken the trouble to have those beautiful maps made, at a very heavy expense. They will be incorporated with our volume. (See pages 308, 337.)

The next paper is on "The Leading Local (Productive) Industries, and their Effect on the Health and Lives of their Operatives," by George Homan, M. D. Dr. Homan desires his paper to be read by title. (See page 327.)

The next paper is on "The Infant and School Population, and Existing Causes Unfavorable to their Health," by J. B. Kingsley, M. D., professor of physiology and diseases of children, Missouri Medical College. (Read by title.)

The next paper is on "The Chief Local Factors in the Causation of Diseases and Death," by Robert Luedeking, M. D., professor of pathological anatomy, St. Louis Medical College. That paper is to be read by title. (See page 329.)

I have a paper on "Hydrophobia," by Dr. Partridge, a member of the state board of health of Indiana. (See page 293.)

A MEMBER.—I move that it be read by title.

The motion was adopted.

The SECRETARY.—The Executive Committee report on the part of that committee the following Committee on the Lomb Prizes. (See Officers and Committees.)

The PRESIDENT.—The last business in order is the announcement of the members by the Advisory Council.

The secretary read the names. (See Officers and Committees.)

The SECRETARY.—Mr. President, the following resolution is offered by Dr. L. H. Montgomery, of Chicago:

Resolved, That the thanks of this association be hereby extended to the retiring president for the able, impartial, and prompt manner in which he has rendered his decisions at this meeting.

The resolution was adopted, Dr. Reeves, first vice-president, in the chair.

The PRESIDENT.—I am very much obliged to you, gentlemen, for your favorable opinion of the manner in which I have conducted the meetings of the association.

I will not detain you by making any extended remarks. I only wish to congratulate you on the good work you have done, the able assistance you have rendered me, and especially to pay tribute to the energy, zeal, and coöperation of this admirable local committee, of which Dr. Spiegelhalter is chairman and Dr. Homan secretary. Nobody but myself and Dr. Watson can conceive of the enormous amount of work they have done, and the great efforts they have made to contribute to your pleasure.

Wishing you a happy journey home, and hoping to meet you in Washington at the next annual meeting, I now declare the twelfth annual session of the Public Health Association adjourned, *sine die*.

DR. REEVES.—The members of the Executive Committee will please retire to the secretary's office, as an important meeting is to take place.

The PRESIDENT (Dr. GIHON).—I beg to announce, as chairman of the new local Committee of Arrangements, Dr. Smith Townshend, of the city of Washington, health officer of the District of Columbia.

ADDRESS FROM THE PROVINCIAL BOARD OF HEALTH TO THE AMERICAN PUBLIC HEALTH ASSOCIATION.

By CHARLES W. COVERNTON, M. D., Chairman.

Mr. President: As a conjoint delegate with Dr. Bryce from the Provincial Board of Health of the Province of Ontario to the twelfth annual meeting of the American Public Health Association, and a delegate from the dominion government of Canada to the International Conference of State Boards of Health, postponed from August last, at Washington, to the present date in this city, it affords me very great pleasure to testify to the great interest that is increasingly attaching to all that is said and done at these reunions of members of our profession, as also of distinguished laymen, who take a warm interest in the advance of preventive medicine.

The industry and tenacity of purpose that this association and the numerous state boards of this vast country have for long years displayed in the prosecution of this branch of our science, affords abundant evidence that you have not considered it to be limited to the preservation of health and the diminution of disease, but that you have aimed at the amelioration and perfecting of bodily strength, vigor of constitution, and full development of all the powers of the system by early training, judicious education, and properly regulated bodily exercise. As an illustration of your acceptance of the French proverb, *Prévenir vaut mieux que guérir*, you have perseveringly insisted upon proper drainage of both country and city, on adequate and pure water-supply, efficient sewerage and disposal of sewage, proper ventilation of dwellings, removal of organic *débris*, hygienic regulation of workshops, factories, schools, hospitals, asylums, and penitentiaries. These and a great number of other important subjects have been for a great number of years your constant study; and of the success of your labors, in the circulation of a large amount of sanitary knowledge by health treatises, pamphlets, and admirable yearly reports from your numerous state boards, the control of epidemics, and the greatly diminished death-rate, afford convincing evidence.

I much question, sir, whether the magnitude of the work accomplished in this noble labor for the last thirty years by such untiring enthusiasts as Bowditch, Elisha Harris, Draper, Billings, Folsom, Cabell, yourself, and a host of other eminent men in the various states of the Union, many of whom are here assembled, is other than imperfectly known, and still less appreciated. The same remark may apply equally to distinguished workers in this cause in England and other European countries. Witness the comparatively slight recognition by the state of the invaluable

labors of Chadwick, Farre, Simon, Carpenter, Richardson, and others. Sir Spencer Wells, in an address delivered some years ago, remarked, "What indeed could be so disheartening to a learned profession as the fact, that while for the affair of Magdala Lord Napier was honored by a title and rewarded with a pension, the extended average duration of life of the whole population, and its actual increase due to sanitary and medical science, far exceeding in importance the annexation of a province or of a kingdom, has earned for Mr. Simon the barren right, shared by many less honorably known men, of putting the two letters, C. B. after his name; and William Farre still remains without any mark of national gratitude." The same want of adequate recognition of services rendered, I apprehend, sir, exists equally in your great republic. If, however, there exists reason for complaint of an imperfect state recognition of the important work of preventive medicine, the profession and general public appreciate fully the patient care, sedulous attention, and continued vigilance exercised over causes of disease by sanitarians.

The yearly meetings of this and other similar associations in the several states of your Union, and the international congresses of hygiene in Europe, assembling every two years for the purpose of conferring on all subjects connected with the science, and the great increase of late years of minute microscopic investigations into possible causes of disease, either from water, air, or food, all point to the untiring zeal of the devotees to this branch of medicine, and to the conclusion that they are far from entertaining the opinion that the end of human investigation into obscure diseases has been reached. May we not, on the contrary, indulge the hope that advanced pathological knowledge, continued attention to microscopical research, careful watching effects of rise and fall of groundwater, patient meteorological investigations, and a careful attention to the condition of immigrants on arrival at our seaports, may to a very great extent accomplish immunity from epidemic diseases? Dr. Lionel Beale has estimated, that for the price of each monster cannon, governments might secure the services of a skilled microscopist, and at the cost of each discharge might carry through an important investigation into the nature of disease.

The good effects of health associations, when worked as this national one has been, are generally known and acknowledged. They have not for their object simply the acquiring of knowledge, but the more useful one of communicating it in announcing discoveries, deducing general laws from numerous facts, correcting false theories, and rendering it acceptable and pleasing. Thus are brought into a common stock the gatherings of each, the sum total made larger, and a common interest imparted. The debates upon points of difficulty and on diverse theories will awaken a spirit of inquiry, quicken the mind, sharpen the wit, and soften asperities. What better system for the discussion of the various subjects connected with state medicine could be conceived than these congresses? From a hygienic point, as also from others, Canadians may learn much from their cousins on this side of the line. We acknowledge indebted-

ness to the yearly reports of your state boards, *e. g.*, Massachusetts, New York, Illinois, Michigan, Missouri, West Virginia, and others. Valuable assistance has been derived from them since the inauguration of our Ontario board. As the present chairman, I desire to offer my thanks, as also those of my colleagues, for the fraternal kindness we have invariably received at the hands of the officers and members of these boards; and to say further, that nothing would afford us greater pleasure, to express in deeds rather than in barren words our appreciation of these courtesies, than by your giving us the opportunity of entertaining you at the next annual meeting of this association in our city of Toronto. In this expression of our board I am authorized to say that the desire is reciprocated by our Minister of Health, the Hon. Mr. Ross, and I am well assured is equally reciprocated by the profession generally of our queen city.

In conclusion, Mr. President, allow me to express the sentiment,—"May the American Public Health Association long continue its great work of sanitary reform, and ever be distinguished in the future as in the past by the ability and zeal so conspicuously displayed by its founders and present members." *Floreat Hygiea.* I believe the celebrated David Crockett prefaced to us the pertinent phrase "Go ahead," with "Be sure you are right." Sanitarians know that they are right, and will endeavor, in spite of all obstacles, persistently to go ahead.

FIFTH INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY,

HELD AT THE HAGUE, AUGUST 21–27, 1884.

REPORT BY DR. A. C. GIRARD, U. S. ARMY, MEMBER OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, AND MEMBER OF THE CONGRESS.

In presenting this report, I consider it understood that a description of festivities, speeches, and excursions is not expected. So far as possible, I am writing from personal notes, using, where two sections sat simultaneously, an extract of stenographic notes of other reporters. The work of the sections is given first in their order: the general sessions are grouped together at the end of this report.

FIRST SECTION.

1. At the first international congress held at Amsterdam, a commission, composed of Messrs. Van den Corput of Brussels, Le Roi de Méricourt of Paris, De Chaumont and Lewis of Netley, and da Silva of Lisbon, had been instructed to prepare a project of forming an international medical league for mutual instruction in the epidemic development of infectious diseases, and deliberations as to the best measure to prevent or limit their spread. This report was due to-day. Prof. Van den Corput, the reporter, being absent, it was determined nevertheless to discuss the question and take action. A number of distinguished physicians spoke in favor of the project, and finally, by a large majority, the following propositions of Proust, of Brussels, was accepted: To organize a new international congress; to form a permanent scientific commission for epidemic diseases, which is to correspond with the health boards of the different countries; and to prepare an international code of health laws, with the expressed wish that Holland take the initiation.

2. Dutrieux-Bey, a Belgian physician in the employ of the Turkish government, spoke on the subject of quarantine. He first remarked that the cholera at Damietta and Toulon proved its inefficiency. While he admits that cholera is contagious, its danger of infection is less than that of typhus. Usually it remains localized, unless its spread is favored by peculiar conditions. At any rate, prophylactic measures are necessary, but simple quarantine is not sufficient. Of the five great epidemics of this century in Europe, two were imported overland, two started in it, and one was introduced by water, although this is not proven. As to the length of quarantine, while formerly twenty-three days were considered sufficient, nowadays forty-five are thought to be the limit of incuba-

tion. Quarantine is only applicable to islands. For a continent it is useless, especially as most first cases are not recognized. He does not admit the distinction between cholera nostras and Asiatic. The difference is only in the intensity. The cholera is not transportable as such by ships or railroads. As a conclusion, he rejects quarantines as useless, and proposes to replace them by a strict hygienic inspection of seaports, as it was proposed at the Vienna congress, and a severe application of hygienic rules and disinfectants. (This view of the unity of the two diseases seems to be supported by the latest researches of Drs. Prior and Finkler, of Bonn, who claimed to have discovered the bacillus of Koch in thirty-two cases of cholera morbus, with the spasms and nervous symptoms peculiar to Asiatic cholera. The bacilli and spores were exhibited in the "Reunion of German Naturalists and Physicians" in Magdeburg, September 21.—Rep.)

The discussion was a heated one. Proust of Paris, Brouardel of Paris, Zoëros-Bey of Constantinople, Crocy of Brussels, and Rochard of Paris, strongly urged the duality of the disease, questioned the accuracy of Dr. Dutrieux's observations, and denied the existence in Marseilles of the cholera since the 17th of January, as alleged by Dutrieux.

A proposition of Rochard to maintain quarantines, but to improve them, was almost unanimously carried. A counter-proposition made by Dutrieux at a later session, to replace quarantine by vigorous medical inspections and complete disinfection in case of disease, was rejected by a small majority, a number of members abstaining this time from voting.

A paper on the "Utility and Necessity of the Creation of Chairs of Hygiene and Hygienic Laboratories at all the Universities" was to be read by Dr. Fodor of Budapest, but in his absence an extract was presented in German by Dr. Emmerich, of Munich. The reasons in favor are too well known to need repetition. The section adopted resolutions that the congress make recommendations to that effect to the different governments, and that a committee be nominated to follow up the matter. (No committee was appointed, to my knowledge.—Rep.)

3. *Results of the investigation on the transmissibility of pulmonary phthisis.* By Dr. A. Corradi, of Paris.

The researches were made with his colleagues in Italy, and were formulated as follows:

a. The contagion of pulmonary phthisis is possible.

b. Certain favorable conditions must exist, such as prolonged personal intercourse, and all the causes lessening resistance.

c. The possibility of transmission by means of clothing is not sufficiently demonstrated.

d. It is also doubtful if the milk and flesh of tubercular animals may cause transmission, especially after cooking.

e. Prophylactic measures can only be carried out so far as personal interest is concerned.

f. Inquiry on these subjects should be continued in various countries and by means of uniform formularies.

Vallia, of Paris, believes that the danger of contagion should not be overrated. It is much less than that of measles or scarlet fever. Tubercular affections of the mouth and larynx expose more to contagion than others. Expectorated matter should not be received in cloths, being liable on drying to be carried in the atmosphere. Great care should be exercised in health resorts for consumptives. The rooms should be simple, with as little furniture as possible, to facilitate disinfection at the change of occupants. Vaccination should be practised from very young children not supposed to be so liable to phthisis, or, still better, from bovine virus, the animal to be killed and examined before using the vaccine.

Jorisserme, of Lüttich, is in favor of hospitals on the plan of monasteries, with single cells. He spoke also of the necessity of using disinfectants, as i. e. permang. of potash in the cuspidors of consumptives.

Teissier, of Lyons, believes that the danger of infection cannot be exaggerated.

The last proposition of Dr. Corradi was then adopted by a unanimous vote, and a commission of four members prepared for the next session a formulary.

4. *Measures to be taken in the first case of epidemic contagious disease.* By Dr. Van Tienhoven, of the Hague.

The speaker correctly insists on complete isolation, but with less practical view believes that the physician who took charge of this first case should shut himself up with his patient. He describes a little wooden building with one door and one window, which he had constructed for this purpose at the hospital at the Hague. Over the bed he suspended a rectangular funnel, with a pipe as a chimney, in which a gas flame acts as an aspirator, and at the same time burns the exhausted air. A small furnace and a steambox in this room are to either destroy or disinfect clothing and utensils. The apothecary is to read the prescriptions through the window. A lively discussion ensued on the diseases supposed to be treated in this manner, and the possibility of recognizing the first case. The French physicians consider such a report of a first case as a violation of professional obligation.

5. *Infected rags, a national and international danger.* By Dr. Ruysch, of Maestricht.

After mentioning the well known causes of danger, and the difficulty of dealing with them, he proposed, in place of the general disinfection of *all* rags before their exportation (a difficult and costly proceeding), to require a rigorous inspection of all rags in a country where a contagious disease exists, and formulates the following rules:

a. Establishment of stations of disinfection.
b. The warehouses to be outside of inhabited places.
c. Transport the rags in bales or boxes.
d. Provide for constant ventilation of the warehouses.
e. Protect as much as possible the workmen sorting the rags.
f. Disinfect them and their clothes after working hours.

g. Prohibit the sale of bedding or clothing used by persons suffering from a contagious disease.

h. International rules for the transportation of rags.

The part of the conclusion of Dr. Ruysch, pertaining to the danger of rags and the necessity of taking precautions, was accepted. A commission to be nominated by the organizing committee, with the addition of a certain number of industrials, to protect the interests of commerce, is to study the subject and report at the next congress. The following communications were made:

1. Prof. Stockvis, of Amsterdam, on *The role of the microbes in contagious diseases, from a biological and chemical point of view.* Leaving aside their mechanical action, he explains that infectious diseases have a nature different from all others; that in the blood of persons affected there exists a crystallizable substance, resembling the alkaloids, called ptomaïne, which is produced by the microbes, and is as poisonous as nicotine, which it resembles. The microbes further decompose the organic compounds of the body into the chemical molecules, which then act as poisons. This explains the febrile symptoms.

2. Dr. Raymondand, of Limoges, read a paper submitting a *Project of a universal society defensive against the great epidemics.* The paper had no particular practical value.

3. *Yellow fever in relation to international hygiene.* By Dr. Caro, of Madrid.

The gist of the paper was, that yellow fever is nowhere indigenous except in the Gulf of Mexico, consequently is always imported, and that energetic quarantine is necessary to protect against it.

4. *Diphtheria in man and pigeon, and its cause in habitation.* By Dr. R. Emmerich, of Munich.

As an original research in pathology this paper was very interesting, but did not belong in a hygienic congress.

Emmerich declares that he has found the bacillus of diphtheria (this was already established in the Copenhagen congress by Dr. Nelson, of New York—Rep.), and inoculated it successfully on pigeons and rabbits. It appears under the form of short rods and long micrococci, and can be cultivated on gelatine at a temperature of 15° C. It appears that the disease has been propagated from the pigeon to mankind. The Guinea-pig is not susceptible, but the pigeon and rabbit are markedly so. The bacilli have been demonstrated in milk: they are also found floating in the atmosphere. Soil, in the usual favorable conditions, will favor their breeding.

Diphtheria is more frequent in winter. This is explained by the indoor life and consequent greater facility for infection. He exhibited cultures in gelatine resembling nails with large concavo-convex heads.

5. *Turkey and hygiene.* By Dr. Zoëros-Bey. The speaker relates all the precepts of cleanliness enjoined by the Koran, which, if they were all followed, would make the Turks the cleanest people in the world. Unfortunately, the indolence of this nation leads to much uncleanness,

which the speaker admits. He alleges that a period of scientific light, however, has dawned in Turkey, under the auspices of the present sultan, who is a fervent hygienist.

6. *Cow-pox*. By Mr. Philippi, vet. sur., of Rouen.

He proposed to show that cow-pox is only an attenuated form of horse-pox, which theory Pasteur also sustains. Horse-pox is the original disease communicated to the cow. Proof is, that no cow has ever shown immunity against the cow-pox, and no male bovine has ever taken the disease. Therefore the virus of the horse-pox, modified by the cow, is the preserver against variola. Horse-pox directly communicated to mankind causes a grave disease with fever and high inflammation. Drs. Layet and Verstrarten believe they have met with the primitive cow-pox.

SECOND SECTION.

1. *On the dangers resulting from the destruction of forests, and advantages of covering the dykes with vegetation.* By Prof. Schwappach, of Giessen.

The effects of clearing on the climate of countries formerly covered with forests are an elevation of the extremes of temperature and a diminution of mean humidity. The degree of the latter depends on the constitution of the soil. The diminution in the number of springs is less sensible, but their size is notably increased.

On adjoining localities the effects of clearing are disastrous by a loss of protection against dry winds, and also against storms, the more so the flatter the country is. The effects on the *flow of water* are, that a large quantity which formerly was extracted by the roots remains in the soil, often leading to swampy nature, surface-water, and that in the higher strata of the soil it evaporates to the detriment of springs. The course of small rivulets is not arrested by trunks and roots as formerly, leading to rapid rises and falls of the rivers after rains. The effects on the *fixation of the soil* are washes and crevices in the mountains and quicksands in the lowlands.

The advantages of covering the dykes with vegetation are to prevent their caving and migration, and to protect the adjacent grounds against high winds.

The speaker also mentioned the advantage obtained in the Romagna by surrounding habitations with the eucalyptus, by which means places, which had to be deserted on account of the fatality of the fevers, became healthy. (Tomassi-Crudeli, at the congress of Copenhagen, considered the benefits attributed to this plant as exaggerated, and attributed the increased salubrity of the Romagna to simultaneous drainage.—REP.)

Durand-Claye, of Paris, remarks, that consequent upon the clearing of the forests at Montpensier there was an *increased* rain-fall, while the planting of forests in the neighborhood of Marseilles was followed by a *diminution* of rain.

Dr. Blasius, of Brunswick, recommends government control, and pro-

poses that a wish be addressed to the Dutch government to bring about international legislation on the subject, which did not seem to the taste of the audience.

Dr. Sayka, of Prague, believes that the disappearance of malaria from the Trappist convent in the Romagna is due more to a disappearance of surface-water, consequent upon which the culture of the microbes, which need at least 10 per cent. of fluid in the soil, ceased.

2. *Cremation may render important services, even when the cemeteries are organized according to the principles of hygiene.* This report was due from Dr. McGillavey, of Leyden, but owing to his absence Mr. Symons, an engineer from Rotterdam, explained the construction of cremation furnaces.

3. *Last results of the use of Liernur's system of sewerage*, reported by Mr. Bergsma, principal engineer of the Liernur Company.

This system intends to prevent the infection of rivers caused by flushing systems, and removes the excrements, as dry as possible, by aspiration, leaving the liquid refuse of house-keeping and industrial establishments to be evacuated by another system of pipes in the ordinary manner. The excrements are not supposed to see daylight until they are rendered inoffensive. A reservoir, placed outside the building and in connection with the soil-pipes, is by means of an air-pump (connected with a central reservoir) exhausted, and the whole is spread immediately over the field. In some cases it is first dried, treated with sulphuric acid, and used in powdered form as a kind of human guano. Amsterdam was in 1870 provided with a little movable machine evacuating one hundred and thirty houses. At present 3,100 houses, with 50,000 inhabitants, are in communication with the system. The city of Dordrecht has adopted this system also. The hygienic commission of Prussia reported in its favor.

Mr. Bergsma invited the members of the congress to inspect the system at Amsterdam.

Mr. Durand-Claye, engineer-in-chief of the Ponts et Chaussiers in France, spoke in favor of the flushing system, and the use of the excrements in a liquid condition to manure the outskirts of Paris, and thus avoid the pollution of the Seine, which has no more the necessary current to carry the contents of the sewers to the sea. The entrance of sewer gas into the house is prevented by a peculiar system of valves in and out of the house.

Mr. Derverdy, of Paris, criticised this system of irrigation, for the reason that the supply exceeds the demand, and it is difficult to find the necessary surface. This obtains in Paris, as well as in Berlin and Brussels, where the system has been abandoned.

Mr. Neujcan, of Lüttich, proposed another system, that of pumping out the contents of the large sewers by means of strong machinery, at the same time pumping them into large pipes and thence into throughs lined with masonry, where they were to be treated with different chemicals, the chemical action producing sufficient heat to destroy all possible germs.

The gases of the sewers could be extracted by the means of aspiration through the chimneys of the generators.

Messrs Trélat and Robinet, of Paris, believe that the Liernur principle is good, but only in theory.

Mr. Derverdy remarked that the system used in Paris relieved the city and infected the suburban population.

The Liernur system seems to approach the nearest the desideratum of ultimate disposition of excrementitious matter.

THIRD SECTION.

Prof. Brouardel, of Paris, reported for final action the proposition made by him at the congress of Geneva to prepare an international code on *the adulteration of food.*

Adulteration is practised by great firms commanding large means and employing skilful chemists. As quick as the means of detecting certain adulterations were found, new combination were invented, defeating chemical analysis. Even if in a few years the process were discovered, large fortunes had meanwhile been realized, and many persons injured. It was impossible to obtain a verdict against manufacturers who used poisons in such small doses that no immediate, discernible effects resulted. Even after detection the manufacturers had only to transfer their business to some other country, to escape for another lapse of time. There was no common understanding between the nations in the matter. What was condemned in one country was allowed in another, thus facilitating competition with lawful business. He cited the case of coloring of common toys, regarding which German laws are less stringent than those of France.

He recommended that an international commission be appointed to collect information on the following points:

1. Determine the evil effects attributed to the ingestion of the different substances used to adulterate articles of food. Request the particular attention of physicians attending workmen employed in such factories, recommending a systematic register to be kept of the health of these workmen, to be used in the investigation of this new pathology.

2. Collect the methods used by the chemists, especially those who have charge of laboratories intended for the analysis of adulteration of food, and request them to devise easy methods to be applied by physicians in the detection of the absorption of such substances by the workmen in the factories.

3. Collect in the different countries the laws against adulteration of food, and communicate the results obtained.

4. Make on these subjects such remarks as they may deem useful.

At a subsequent meeting, a commissioner was elected for each country represented: for the United States, your reporter.

2. Dr. Menns Huyzinga, of Harlingen, then presented a very scientific report on the effect of over-pressure at school. It was not so much

study, as distasteful study, that proved injurious. The curriculum of schools was little better than an advertisement, suppressing individual tastes, and ignoring mental capacity. This learning by rote was more a preparation for display in examination than a preparation for after-life. He advised the separation of the programme of schools into obligatory and free studies, and the abolition of examinations for promotion from one class to another, preferring to them the certificate of the teacher. Examinations should be limited to those desiring to obtain public offices, especially for the *jes docendi*.

This discussion was participated in by Lublinsky of Warsaw, Zoëros-Bey of Constantinople, and Verspyk of Holland, and tended in the same direction, strongly advocating obligatory gymnastics, abolition of punishment for failures (relying entirely on emulation), and of home lessons.

3. *The danger of alimentation with meat and milk from tuberculous animals.* Reported by Prof. E. Vallin, of Paris.

The following were his conclusions:

a. The tuberculosis of animals (pommelière, Perlsucht) is identical with that of the human race.

b. It is proven that raw tubercular meat may cause tuberculosis.

c. It is proven that subcutaneous or intraperitoneal infection of blood, or muscular juice from phthisical animals, may produce tuberculosis.

d. Ingestion of raw meat coming from tubercular animals may in certain cases produce tuberculosis, especially of abdominal kind.

e. The danger of infection is removed by cooking, but needs a higher temperature than that usually attained by the modern roasts.

f. The milk of tuberculous cows is suspicious, and is particularly dangerous, if the mammary glands are affected.

g. Boiled milk is inoffensive.

h. To prevent danger, the meat of animals suffering from general tuberculosis, with commencing loss of flesh, should be prohibited, and seized.

i. The use of rare meat should be discountenanced. Milk should always be boiled.

k. The frequency of tuberculosis among cattle should be diminished by choice of breeding animals, reform in stabling, isolation of sick animals, and disinfection of contaminated stables.

l. Tuberculosis of horned cattle should be classed among contagious diseases, and treated likewise.

m. Insurance companies should be encouraged to indemnify cattle-owners in case of seizure.

Dr. Jorisserme, of Lüttich, believes it would be to the advantage of the working classes to sell at a cheaper price meat coming from tuberculous animals.

Dr. Felix, of Bucharest, states that in his country the government levies a tax on each animal butchered, therewith raising a fund to indemnify for seized cattle.

COMMUNICATIONS.

1. *Prevention of blindness, and physical education of the blind.* By Dr. M. Roth, of London.

Experience of the institutions for the blind shows that the majority of cases originate immediately after birth, and with appropriate treatment would have been easily curable, while accidents, eruptions, and general diseases are the less frequent causes. (There are less cases from variola since introduction of vaccination.) Ignorance and neglect of parents and nurses, teachers of the working classes, contribute vastly to the number of the blind. In England a large society was formed to prevent blindness. (There are 60,000 blind in England.) Dr. Roth then made some very interesting remarks on the gymnastical education of the blind.

2. *Prejudice as a cause of blindness.* By Dr. Van Dvorerrsaal, of the Hague.

This speaker spoke in the same strain as the preceding one. His remarks present nothing new.

3. Mr. Joël, of Lausanne, reported on the progress of *hygiene in schools* since the congress of Geneva. (I did not hear this lecture, and was unable to obtain an account of it.—Rep.)

4. *Dangers for respiration and ear in the habit of breathing through the mouth.* By Dr. Guye, of Amsterdam.

This habit is either a vice, or the result of an obstacle in the nasal passages. The difference between the two modes of respiration is, that through the nose the air becomes heated; passing over the nasal walls, it is moistened, and deposits mechanical impurities. Through the mouth the air is cold, often too dry, and charged with organic and inorganic particles. The cold has a bad effect on the teeth; the dry air dries the throat, especially during sleep. Cough may result from it. Many asthmatics are cured by removing obstacles in nasal respiration. Young children and savages breathe through the nose. Breathing through the mouth is an acquired habit. To cure it, several bandages have been invented. During the day a pebble may be carried in the mouth. Dr. Guye hopes that physicians will popularize these principles.

5. Dr. Raymond read a paper of Dr. Permasson, of Limoges, with the conclusions of the necessity of advising the public of the danger of using vessels and utensils of persons sick with contagious disease without previously boiling them, and to prohibit the use in hospitals of iron or earthen vessels unless they are enamelled.

6. Dr. Dutrieux-Bey spoke of the necessity of an international understanding to prevent the introduction of alcoholic liquid into the interior of Africa.

7. Mr. Poincaré, of Nancy, read a paper on the nutritive value of meat powders, with experiments, and arrived at the following results:

a. Beefsteak-powder is superior in nutritive value to bread accompanied by broth, but inferior to fresh meat.

b. It cannot be considered as a substitute of lesser volume.

c. In the absence of bones, it leads in dogs to a rhachitic condition.

d. It may act on the digestive organs like putrid food.

e. It should not be used except as a last refuge.

8. *Experimental researches on the artificial perfumes*. By Mr. Poincaré.

A pretty large dose is required to produce any effect (five to six C. C. in the dog), which then takes place suddenly with great prostration and rapid coma, accompanied by intense dyspnœa, expulsion of large quantities of foaming and bloody mucus, and general trembling. The poisoning is nevertheless not fatal. On dissecting the experimental animals, we find congestion of the digestive apparatus, with ecchymotic patches, congestion of the nervous centres, and obstruction of the bronchi by mucus. Practically, we may declare that the infinitesimal dose taken with caustics have no appreciable effect.

FOURTH SECTION.

1. Dr. Napias, of Paris, spoke on the "*Right and duty of the state to provide for healthfulness of work, and security of workmen*."

This legislation should comprise the hygienic condition of the workshops, the safety of mechanical appliances, the prescription regarding age, sex, and working hours, the mode of protecting the neighborhood of industrial establishments, the provision, in case of reduction of work, in sickness and in old age, hygienic laws concerning the homes of workmen, the construction of cheap lodgings.

Mr. Smith, of London, during the discussion, recommended that in order to render the homes of the poor wholesome, they should be protected against starvation wages by preventing overwork, and establishing minimum wages, below which it should be illegal to employ any one. Workmen thus receiving sufficient wages could be compelled to live in proper lodgings. He also spoke on the want of independence of inspectors in England, and the power of manufacturers as legislators and judges.

Mulherbe of Lüttich, and Studer of St. Gallen, are opposed to too much legislative interference, and believe that more has been achieved in several countries by private initiative. The example of the late Mr. Warocquier of Hainant, and of Mr. Van Marken of Delft, are mentioned as particularly successful private efforts.

2. *Functional differences of the eyes*. By Professor Donders, of Utrecht.

He introduced his lecture by a historical sketch on the different views of painters and physiologists as to the number of fundamental colors. Leonarda da Vinci admits four—red, yellow, green, and blue. So does Herring. Young distinguishes three. Dalton, by means of the spectrum, resolves them into two. This is what the Daltonist sees. If he sees more than two, he can see two hundred. The eyes of the Daltonist

are, from a morphological point, healthy: viewed hygienically, they are not. Still, Donders has never seen an absolutely normal eye where there was imperfect perception of colors. A person blind to red never shows any sign of transition to normal sight. Feeble perception of color can be detected by the multiple spectroscope. This condition occurs very frequently, at least one in seventeen. To determine the sense of color, we can use either a table, with the four single colors in a saturated condition, or use the iso-chromatic tables of Stilling. Practically considered, we must require normal sight from the principal railroad employés; for the rest a feeble perception may suffice. For the navy we need be less strict; and for the military it is unnecessary to insist on it as long as the right eye is sound.

3. *Voluntary restriction of procreation, viewed from a humanitarian and social side.* By Dr. Layet, of Bordeaux.

The speaker remarks on the consequences, as leading to a number of sexual and nervous diseases, of increase in illegitimate children, of decrease in country population, favoring vice, and inducing emigration. As a remedy, he would see marriages favored, premiums for legitimate children, and increase the population by founding colonies.

Dr. Felix, of Bucharest, speaks of prevention of conception and intentional abortion as being mentioned in the oldest records of mankind. He does not know of any remedy.

4. *On the influence of insurance companies, called "funeral societies," on the mortality of young children.* By Dr. Snijders, of Gravesend.

This speaker refers to certain life insurance companies, dealing mainly with the poorer classes, which, for a small weekly premium, pay a certain sum to the heirs of its members in case of death, insuring whole families, and making no charge for infants, but paying in case of their death a gratuity.

The speaker believes that this system awakens an incredible cupidity, and in many cases leads to premature death of weakly children. Often parents would insure in several of these companies, with clear premeditation of the probable death of an infant, and thus secure to themselves a considerable sum. He would recommend the passage of laws prohibiting the insuring in more than one "funeral society;" also prohibiting these gratuities, and requiring the insuring of children under ten years, and the production of a certificate from a physician that the defunct had received proper care and medical assistance.

After some discussion, a vote was passed recommending the suppression of insurance companies which allow an indemnity for children below the age of ten years.

COMMUNICATIONS.

1. *Researches on the dangers of the fabrication and use of aniline colors.* By Mr. Poincaré.

The speaker first gave a list of those to be considered poisonous, and those not. The first should be prohibited in the coloring of toys, wines, and liquors, the more so as in commerce they usually contain arsenic, mercury, or lead. The second class may be tolerated, but should be tested for arsenic. It is safest to prohibit all except those of a vegetable nature. Less care need be bestowed upon the coloring of tissues and papers, providing the colors are fixed so as not to stain the fingers of persons handling them.

For the protection of workmen, a list of the poisonous dyes should be posted in the shops, which besides should be well ventilated, with apparatus for condensing or burning dangerous vapors. Strict supervision should regulate cleanliness, and prevent the taking of meals in the shop. He recommends that glass cages, with openings for the arms, be provided for the persons attending the mixing, sifting, and packing of the colors.

2. *Asthma of rye cake manufacturers.* By Dr. Verstracten, of Gand.

Whenever they inspire a large quantity of the rye-dust, they suffer from sudden and violent attacks of asthma. Microscopically, he found, after the termination of the spasm, in the expectoration a large number of amorphous angular bodies of brown color with transparent edges. The same were found in the atmosphere of the work-shops. A short stay in them produced sneezing. The attacks of asthma could always be traced to a prolonged exposure. It was sufficient, to cure the disease in a few days, to leave the place. A muslin mask or a respirator will prevent it.

3. *The organization of the "crêches" in France.* By Dr. Blache.

The "*crêches*" are establishments where infants under the age of two years are left by working people during the day. The mothers have to attend to the nursing of the infants at least twice daily. When the mothers fail to appear, supplementary food is given. There is less danger of epidemics in these establishments on account of the careful watching, which detects disease early. The children, in case of sickness of a contagious nature, are sent home; and if anything like an epidemic breaks out in the "*crêche*," it is closed and disinfected. These establishments are a great benefit to poor children.

FIFTH SECTION.

This is the section of demography.

1. *Mortality in Switzerland.* By Dr. Kummer, of Berne.

The following were his conclusions:

a. The statistical bureaus are requested to give, in their mortality tables, not only the percentage of deaths as to inhabitants, but also as to classes of age: first year, one to four inclusive, then up to twenty-five, in classes of five years, and after that in classes of ten years.

b. The causes of death should be registered in the same manner.

c. Those causes on which international comparisons are desirable should be entered separately.

2. *Method of calculation of death-rates according to the causes of death.* By Prof. Boeckh, of Berlin.

He also recommends the establishment of age-classes with separate entries of cause of death, and the number of years not lived, taken from methodical mortality tables, thereby giving the total mortality attending each cause, and the measure of the degree of its deleterious influence.

3. *Mortality by epidemic disease in Paris since 1865—illegitimate children.* By Dr. Bertillon, of Paris.

He first established a comparison between legitimate children and those born out of wedlock. Of 1,000 unmarried women in Ireland, 6 had offspring, in Holland 9, in Switzerland 11, in France and England 17, in Italy 20, in Sweden 22, in Prussia 23, in Denmark 29, and in Bavaria 41. Of illegitimate children, there were, of 1,000 births, in Ireland 30, in Holland 38, in Belgium 53, in England 61, in Prussia 66, in Italy 73, in France 75, in Denmark 76, and in Bavaria 96.

The right of search for father, which is prohibited in France and the Netherlands, has no influence on the number of illegitimate children. Their number has increased in direct ratio to the impediments against marriage. In Bavaria, since many restrictions have been removed, the situation has improved, although the proportion of illegitimate children is still large, owing to the moral degeneration caused by the old system.

The rate of deaths of legitimate and illegitimate children was then given, showing the latter in some countries to be nearly double the former.

General Sessions of the International Congress of Hygiene.

The first lecture was given by Mr. Jules Rochard, of Paris, on "*The material value of human life.*"

He remarked that the subject was not a new one, but that he would consider it from a hygienic point of view. Hygiene is a science which has been admitted in the large cities. The smaller towns have so far considered themselves generally too poor to allow themselves this luxury. Still, as he will demonstrate, money employed for purposes of hygiene is placed at the highest interest, and in reality is an economy.

Material value of human life differs according to age, sex, education, and social position. So far as age is concerned, the greatest value is represented by the adult age of twenty; the minimum by old age. In youth the value is greater, owing to the prospect of attaining the age of the greatest value. The greatest adversities are sickness, accidents, and especially war, which absorbs the best strength of a nation. The male sex is of greater value than the female, on account of physical strength.

The position is also of great importance. A laborer earns from one to two francs a day, while a skilled workman commands in Paris from four to six francs. A young physician represents a capital of thirty thousand francs. The whole French people represent a value of forty-one mill-

iards, allowing an average value of the individual of one thousand and seventeen francs. Sir James Paget some time ago valued the London laborer at twelve thousand five hundred francs; but he only considered the stout boatman, while Rochard counts in men, women, and children. The reduction of the death-rate is, therefore, a material increase in wealth.

The diseases which carry off most victims are those of an infectious nature. The pest of the middle ages destroyed more than one fourth of the European population, the cholera of 1832, already only one in four hundred. We can protect ourselves against cholera by a rigorous quarantine, irrespective of any commercial losses. Against variola, which in former ages decimated mankind, we have vaccination, which in the most brilliant manner denoted its efficacy in countries where it is obligatory. Scarlet and typhoid fever, which have destroyed large numbers of valuable lives, can be hedged in by hygiene; but so far we have been powerless against the most terrible disease, which causes one fifth of all the deaths,—tuberculosis. This disease causes to Europe annually a loss of two milliards. Since its contagious nature was demonstrated in 1875 by Willemin, and its bacillus was discovered in 1882 by Koch, we have made a step towards reducing this frightful mortality. From a hygienic point of view, we must recommend care in the intercourse with phthisical persons, prevent their marriage, and prohibit the use of meat and milk coming from tubercular animals. (According to Dr. Chauvin's paper, in Copenhagen two per cent. of all beeves are tubercular.—Rep.)

Hygiene well applied is a great source of prosperity. There need be no fear that as the causes of the great destroyers of life are removed the world might become overpopulated. New diseases will always originate as the old ones disappear, such as anæmia, nervous disorders, alcoholismus, morphinismus, etc. Therefore, hygiene should be popularized by all possible means. This, of course, costs money, which can be found in our war appropriations in great plenty, and used to better advantage.

The second lecture was by Prof. Cohn, of Breslau, on "*The measurement of light in schools.*"

After some introductory remarks, complimentary of Prof. Donders, he stated that myopia has been found to be constantly on the increase, and in some schools in a greater ratio than in others. The only common cause to be discovered was the different supply of light, which, owing to the absence of instruments allowing positive measurement, has been arrived at more by exclusion. Hoffmann, of Wiesbaden, first made an effort to reduce these observations to a more mathematical basis, by establishing normal vision as the capacity of reading No. 1 of Jaeger or No. 2 of Snellen at a distance of thirty centimeters, if the room is properly lighted.

To judge of the light of a room we must consider the number and disposition of the windows, the distance and height of neighboring trees, the color of the walls, etc. The proportion between the lighting surface and the floor of a school-room should be as one to five, assuming that no

high building or trees partly obscure the light. A French commission established a rule that the least favorably seated scholar should from his place see thirty centimeters of sky.

In order to obtain an instrument cabable of giving exact results, Mr. Cohn had an apparatus constructed by Weber, of Breslau, a description of which he gave with great lucidity, and which he said would be described in the "*Annalue für Physik und Chemie*" for the month of September. The principle of the apparatus is the comparison of a known light with the one to be determined. It is composed of two tubes,—one horizontal, inserted in the centre of a perpendicular one, and carrying a light of known intensity, which through a movable milk-glass is thrown by means of a prism in the perpendicular tube upon a piece of paper, the illumination of which is to be examined. The observer uses the perpendicular tube, which is double, and thus sees the light caused by the lamp and that of the day. Daylight being white and the light of benzine red, Weber remedied the difference by introducing in the ocular a monochromatic red glass, which allows comparison of the intensity of the lights. By moving the milk-glass to or from the lamp, the two lights can be made to appear of equal intensity, the degree of which can by a simple formula be calculated (taking the light of a candle at a distance of a meter as unit). The cost of the instrument is as yet high, being seventy-five dollars.

The observations made by this instrument have given very uniform results. It has shown that the frames and cross-bars of the windows intercept much light; likewise the curtains, which should open laterally, and not from above downwards. The color of the walls is also of importance. Even the hats and coats of the scholars absorb much light. Several propositions have been made to improve the lighting of schools by means of prisms or mirrors, but these half measures are not sufficient. It would be better to abandon all buildings not sufficiently lighted.

Among the practical advantages of the Weber instrument, Prof. Cohn mentioned that it was an arm against the light-robbing beautifications of public buildings by the architects, who could be required to have every room lighted to a stated candle-power, which could be by means of the instrument ascertained.

The next lecture was by Prof. Finkelnburg, of Bonn, on "*The practical application of the latest progress in the knowledge of morbific germs, for public hygiene.*"

A few years ago the microbiological theory of disease was based on more or less ingenious speculation. At present, by the discovery of certain organic forms, their action in the production of disease is well established, and is based on direct inoculation on animals, as the bacilli of malaria, diphtheria, leprosy, and Asiatic cholera. So far as cholera is concerned, he is convinced that the bacillus is its cause.

The speaker mentions another glorious discovery—that of attenuation of virus, or vaccination of contagious diseases.

He proposes to treat the three following questions: (1) How can we

act against the contagion? (2) What means of disinfection do we possess? (3) How can the individual protect himself?

1. As soon as the cholera germ has left the human body it spreads and multiplies: a sound individual may carry and propagate the germ. It would be difficult to subject all travellers to rigorous quarantines, but the method would be safe, and should always be carried out with persons already affected. But these measures are not always enforced, and the poison is imported, and forms a source of infection. Here Koch's discovery comes powerfully to our aid. If the cholera bacillus is found in the dejections or the intestine, then we have a case of Asiatic cholera, and a sanitary cordon has to be established. Unfortunately, the diagnosis is usually made too late, as we have seen in Toulon. A mistake of this character should be considered criminal. Had the first case in Toulon been isolated, we should not have had this terrible epidemic in Marseilles and Italy.

Of late, sanitary precautions against the spread of tuberculosis have been much discussed, and been carried out, at least in Italy and Spain, so far as transfer from tuberculous animals is concerned, in the use of meat or milk. Still the disease is so wide-spread among the human race that its entire destruction can hardly be expected for some time to come. It is also important to prevent the close intercourse with consumptives of persons affected with bronchial troubles, or some other disease of the lungs; for a diseased mucous membrane is a ready bed for the multiplication of the bacilli. So far as ordinary vaccination is concerned, he believes that the usual accidents following it are the result of transmission of disease, and recommends particular care in the cultivation of the virus.

2. Much has been said about chemical disinfection, and the germs of putrefaction have been mistaken for those of disease. Many chemical substances, such as the sulphates of iron, zinc, and copper, which are inert as to disease germs, will arrest putrefaction. Chloride of zinc acts likewise. Carbolic acid has some effect on morbid germs, while corrosive sublimate has both qualities. A moist temperature of from 100 to 140° C. always destroys the germs of disease.

The mode of propagation of germs differs. Damp soil impregnated with organic matter is a fertile bed of culture. Such is our drinking-water. Chemical analysis reveals nothing: the microscope alone discloses the bacillus. The great danger lies less in the air than in our food and drink.

3. When the system is in a healthy condition it resists easier all infections. The lesson is obvious. This is especially the case in the power of resistance of the mucous membranes. Concerning the protection by vaccination against measles, scarlet fever, and cholera, we have reasons to hope that their discovery is not far distant, but a general virus is not to be hoped for.

The speaker concludes with the hope that the teachings of hygiene be not confined to the universities, but be disseminated as widely as possi-

ble, the cost of this being reimbursed a hundredfold by the saving of human lives.

4. Report of Mme. Bovell Sturge, M. D., on "*Abandoned children dependent on the state.*"

Children deprived of their parents need particular care, owing to their inferior physique, lack of moral sense, and predisposition to vice. The system of gathering them in special establishments, without relation with other children and the outside world, is contrary to the laws of nature. The disastrous effects of this system become mainly apparent by the constant presence of diseases of the skin, eyes, and head, and by the slow intelligence, moral apathy, and, later, the want of initiative of these children. Family life being the normal one, the system of creating for them an adoptive family among well selected country people is not only more advantageous for the health and development of the children, but, in the end, less expensive to the state. Such children, when once they go out into the world to earn their livelihood, need, for the first few years, a supervision on account of hereditary disposition to vice, and the danger possibly arising from intercourse with criminal or vagabond parents. This supervision cannot be official, and must result from the ties formed with such a family. Such efforts, made by the state and individuals, not only fulfil a humane duty, but eventually result in great benefit to society in general and the whole nation.

5. Mr. E. Marcy, of Paris, on "*The forces useful in locomotion*," gave a discourse on the mechanical theory of heat applied to locomotion. He said the great art of life is to produce a maximum of work with a minimum of strength. He exhibited photographs made by Mr. Murbridge, of New York, of horses at full speed, in their different motions. He himself had photographed the different motions of the human body in walking, at one fiftieth of a second interval; he had also invented a dynemograph,—the whole to discover the means of performing the longest trip with the least possible expense of strength. The following were the results obtained:

In running, the quicker the leaps the longer they are. The length of the feet favor, to a certain degree, the rapidity of the gait, while high heels impede walking. Flat heels are best for rapid progress. The rhythm of the step is important from a practical point of view. The faster it is, the longer the steps become, until they reach seventy-six a minute, when the steps become smaller and the distance made lesser. The same obtains if at a running gait the number of steps exceed one hundred and twenty a minute.

The speaker then exhibited a number of instantaneous photographs.

6. Dr. W. H. Corfield, of London, presented an address entitled "*Science the enemy of sickness*," which, while it was exceedingly interesting and well spoken, was of too popular a nature to necessitate repetition in a medical journal. He gave a history of hygiene, from the time of Moses through the Greek and Roman era up to the middle ages, when all science was cultivated by the priesthood alone, and the ignorance of

the people, followed by neglect of the laws of health, and the ensuing frightful epidemics of the black pest, the miliary sweat, typhus, scurvy, variola, scarlatina, and dysentery. In the seventeenth century attention was called to the cause of diseases, pathology became a science, and the great epidemics disappeared.

The orator here mentioned, in very strong terms, the benefits of vaccination. "Ignorance and pride alone can ignore them."

He concluded by mentioning the interest which is being awakened in England on the necessity of disseminating as widely as possible the teachings of hygiene. He himself gives a course of it to teachers, and, together with other members of a commission, has examined more than 2,200 persons in hygiene. He, as well as Prof. Hartley and other English hygienists, believes that such a diffusion of hygiene is the best mode of causing the disappearance of epidemics, diminishing the number of cases of sickness, and lengthening the mean duration of life. It has been observed, these last four years, that consumption has decreased, and that the average duration of life has been increased three and one half per cent.

7. M. Emile Trélat, of Paris, spoke on "*House temperature and respiration*."

He is opposed to heating with furnaces, and advocates fireplaces, which allow the air respired to remain comparatively cool, while the walls of the room are heated by radiation. Mr. Trélat, who is a very fluent speaker, did not have sufficient time to elucidate his views, his address having been delayed by the length of the previous one.

8. Dr. A. Corradi, of Pavia, then presented "*Sketches of sanitary legislation*," commencing with early history, and particularly referring to the sanitary history of Italy, where, through the energy and foresight of the Doges of Venice, the Eastern plagues were checked. In addition to personal efforts, cleanliness, and good food, he believes that the governments should take action, and should unite in attacking these epidemics in their hidden origin.

9. Prof. J. Crocy, of Brussels, then spoke on "*Potable water*," commencing as usual with a long introduction. He finally sub-divided the question of drinking-waters into several others: 1. Its chemical composition; 2. Its physical qualities; 3. Its physiological properties; 4. Its origin; 5. The influences it undergoes on its passage; 6. The quantity of water each individual needs in each country. Water originating from melted snow or ice has been rejected already by Hippocrates; cistern water is not advisable unless it is boiled, because it is charged with all sorts of particles precipitated from the atmosphere. Rain water becomes only hurtful when it contains organic bodies. Ponds are apt to contain microbes, and their water may cause gastric fever. Salts of ammonia in water are only dangerous when they cause solution of copper or arsenic. The best water is that from springs and artesian wells. Lake water is generally good, but may be fed from stagnant pools and then be like pond-water. River water is often polluted with the refuse matter of fac-

tories. The speaker then related the more or less nocivity of the salts which drinking-water sometimes contains. In speaking of the water-supply of Brussels he severely condemns it, and while excellent water could be obtained from the Ardennes (it is true by costly aqueducts), he says that cities always have money for embellishments but none for necessary hygienic works. He believes that it is the duty of governments to have all drinking-water rigorously examined, and that it be their aim to supply the population with a good quality at all times.

Dr. Haltenhoff, of Geneva, the secretary of the international jury on the 2000 franc prize, then made his report. A competition had been invited by the "London Society for the Prevention of Blindness," at the Congress of Geneva, on the subject, "*Causes of blindness, and means of prevention.*" The decision was to be rendered at this congress, and the prize was awarded to Professor Fuchs of the University of Lüttich. A 1000 franc prize, given by another society, for the next best memoir on the same subject, was awarded to a German paper, the author of which will not be known until the approval of the society is received.

Finally, the "wishes" of the different sections were submitted to the general assembly and approved, as follows:

1. The wish expressed by the first section, to call a new international council of hygiene, charged to nominate an international commission and elaborate an international penal code to enforce international hygienic regulations.

2. The wish addressed to the governments to cause permission of cremation.

3. The wish that national and international regulations be established concerning the transportation of rags.

4. The wish that a commission be nominated to examine into the question of the protection of forests.

These wishes, to the best of my knowledge, will remain "pious," as no further action than approval was taken, and the fifth international congress is a thing of the past. The next one is to take place in Vienna.

I cannot close this report without giving my personal impressions of the value and result of this international congress and the mode of conducting it. The social part was a decided success. The physicians of Holland strained every resource to give their guests costly and fine entertainments; and if hereafter I criticise, I do it with hesitancy, as the recollection of their fine wines and sumptuous dinners is well qualified to smother any tendency to cavilling, and I do it only with the hope that we may learn how to avoid mistakes.

If these congresses are a means of bringing men of prominence in the profession together for a good time during their vacation, giving some of them an opportunity of advancing their views, without pretence to serious discussion or any decided results, then this congress fulfilled its aim. I should, however, think it ought to be a higher one. I will, as briefly as possible, give my views as to what this congress, like that of Copenhagen, in part failed in:

1. There were too many questions propounded to arrive at any kind of a result in any of them. The papers were rushed through, and discussion, if any was allowed, was of a desultory character, a few speakers, fond of being heard or hearing their own voice at all times, making remarks on subjects they evidently had not studied. The only subject where a decided interest was shown in the discussion, and where able opposition arose, was that of quarantine; but the discussion was choked off by the leading French physicians, for reasons best known to themselves.

2. Questions not pertaining to hygiene, although carrying its flag in order to be admitted, took up time valuable for more suitable papers. Among others, I refer to the one on diphtheria, with a long series of experiments, which was exceedingly interesting and very novel, but did not belong there, and had scarcely enough hygienic argument attached to keep it in countenance; and this paper kept out a very important one on international hygiene in yellow fever, which had to be read in extract.

3. Another mistake was the very courteous, it is true, appointment of honorary presidents to preside in the sections. As a rule they did not understand the routine of the business, and gave speakers in important questions often too little latitude, and in unimportant ones, too much. I noticed one day that everything dragged, and there was general dissatisfaction with the mode of conducting the section. Reaction set in the next day with a new presiding officer, and, as the rule is in such cases, he carried interference too far. In these congresses, when only six days are allotted to questions of the greatest moment, it is of immense importance to have the balance-wheel of the proceedings governed by a steady and well trained mind.

4. A certain programme was given out for each day, but not strictly adhered to, causing great inconvenience, especially as the sections sat in different buildings, and one had at times to listen to some indifferent subject in place of the one that was sought.

5. The taking of votes on a number of questions was, I believe, an innovation, and under the circumstances a farce. Questions of international importance, such as the utility of quarantine, were put to a personal vote in an assembly where there were twenty Frenchmen, one Englishmen, one Swede, one Turk, one American, one Belgian, one Serbian, one German, one Swiss. No wonder the vote was absolutely French, and while it may be good, it was not international.

6. As to the general sessions, with one or two exceptions, notable among them the paper of Professor Cohn, the papers or discourses were of entirely too popular a nature for an assembly of trained men, and seemed to me a grievous waste of time for the benefit of perhaps a dozen lay people in the galleries.

7. I noticed in both congresses a mistake which caused some inconvenience to visitors, and no doubt much to organizing and reception committees, that of professional men assuming minor offices, as that of clerks. I believe it was a mistake. A good physician will not always

make a good clerk, and in order to keep up a routine duty like it in proper order, the incumbent should have no other obligations. I have no personal complaint to make. I heard a few and noticed others, which, I believe, could be prevented by employing men simply as well posted, courteous clerks. The physicians of the committees could then give an intelligent supervision, and recognize those who deserve or expect recognition without making drudges of themselves, or, what is worse for their guests, leaving their places unoccupied.

REPORTS OF COMMITTEES.

PRESENTED AT TWELFTH ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, ST. LOUIS, MO., OCT. 14–17, 1884.

REPORT OF THE COMMITTEE ON THE MANAGEMENT OF EPIDEMICS.

With a view to eliciting as much information as possible on the subject with which this committee was charged, the chairman initiated the work by a timely request of each member of the committee for a special contribution comprehending his own practical knowledge of any subject related to it. The contributions received were as follows:

I.

CONCERNING THE MANAGEMENT OF EPIDEMICS SUCH AS OCCUR IN ORDINARY INLAND CITIES IN A NORTHERN LATITUDE.

By WILLIAM K. NEWTON, M. D., Health Inspector, Paterson, N. J.

Paterson, N. J., Sept. 1, 1884.

Dr. A. N. Bell, *Chairman Committee on Management of Epidemics:*

Dear Sir: It seemed to the writer that nothing that could be said by him concerning the management of epidemics, such as occur in ordinary inland cities in a northern latitude, would be of interest, or add to our knowledge of the subject; but he has been persuaded that an account of the method followed by the board of health of Paterson, N. J., in the work of attempting to check the spread of contagious diseases, might add somewhat to the value of the report of our committee.

The epidemic of small-pox, which prevailed in this city in 1882 and 1883, seemed to illustrate a few important facts;—first, that an aldermanic health committee, composed of laymen ignorant of sanitary matters, is not the proper body to legislate upon or to manage public health affairs; second, that with an intelligent public health administration there is no necessity for small-pox to gain a foothold in any city; and third, with so sure and satisfactory a preventive as vaccination there is absolute certainty of checking the spread of this disease.

Previous to November 16, 1882 (the date of the formation of the local

health board), there had been one hundred and thirty-nine cases of small-pox in the city, extending over the time from June 10, 1882, to that date. Under the administration of the health committee of the board of aldermen the disease was continually spreading, and the public had become more and more alarmed at the sanitary condition of the city: hence repeated demands were made in the papers and by the public for that board to create an independent board of health, under our state laws, and to turn over to it the management of sanitary affairs. After great pressure, this was done on November 16, 1882, and it was remarkable to observe the effect this action had upon the public mind: what threatened to be a panic passed away, and the people seemed to rest assured that the proper authority had assumed control.

Besides the great unrest that prevailed, the people were aware that the city was losing a large amount of money by the mismanagement of the epidemic. This loss was not only a burden to trade and manufactures, but the city itself had spent about $20,000 in the various endeavors to check the spread of the disease.

As an illustration of how one important branch of the service was managed, the manner of buying and using vaccine may be noted. This important article was purchased from a person not skilled in the selection of the virus, and hence the vaccinations were in a large number of cases total failures. When the board of health took charge the following plan was pursued:

A notice of the existence of a case of small-pox being received, the health officer immediately visited the house. If the case could be safely isolated in the house, arrangements were made for strict quarantine, and the family were made to understand that it was only by favor that the patient was allowed to remain in the house and not taken to the city hospital. They were also informed that any breaking of quarantine would be followed by quick punishment. Quarantine at home was only permitted when but one family occupied the house. Every person in the house, except the sick, was immediately vaccinated. As a rule, two insertions were made, and the people in the neighborhood were offered free vaccination. A placard was placed on the house warning all not to enter, or leave, except the attending physician and the health officer. Upon recovery of the patient he was given a thorough bath, and new clothes were put on. The bedding was removed to the hospital grounds in the ambulance, and burned; sheets, blankets, and underclothing were soaked in a solution of sulphate of zinc; the room, and all clothing left in the house, were then fumigated by burning sulphur for twenty-four hours. If it was impossible to isolate a patient in the house, he was immediately sent, with all his clothing and bedding, in the ambulance to the city hospital. All in the house were vaccinated, and also persons in the neighborhood, and strict watch was kept over the house from which the patient was taken, until the period of incubation had passed. In case of death the corpse was wrapped in a sheet soaked in a solution of sulphate of zinc, and buried as soon as possible.

The method thus outlined worked admirably, and no extension of the disease took place from house to house. Success may be ascribed to the attention paid to details, and to the care with which vaccination was done. One fact struck me forcibly while engaged during the epidemic,—that was, the number of cases which occurred in the filthy quarters of the city. It was remarkable that, with but few exceptions, the victims of the disease belonged to the lawless class of the community,—drunkards, abandoned women, the careless and the shiftless, being attacked.

I will close this portion of my report with a table of the number of cases, which will call attention to the gradual diminution in the number after the health board assumed charge of the management of the epidemic. Prior to the formation of the board there had been one hundred and thirty-nine cases in the city. When the board commenced work there were nineteen foci of infection to contend against. In November, 1882, thirteen cases were noted; in December, 1882, thirty-one cases; January, 1883, three cases, during which month the disease was eradicated from the city.

Attempts have been made also to control the spread of scarlet fever and diphtheria. The following rules were adopted for the management of cases of these diseases:

"1. A notice of contagious disease being received, the health inspector shall at once visit the house, or put himself in communication with the reporting physician, as he may deem necessary. He shall see that the family receives the printed circular of the board, giving necessary instructions regarding the danger of contagion, the method of disinfection, etc. He shall keep observation of the case until its termination.

"2. The secretary shall notify the board of education, or the principals of private schools which the sick children may attend.

"3. The registrar of vital statistics is required to notify the health inspector whenever a certificate of death from scarlet fever or diphtheria is received by him.

"4. The health inspector may give a permit allowing the children to attend school, after he is satisfied that there is no reasonable danger of carrying the disease; he shall give no such permit, however, in less than thirty days from the beginning of the sickness, unless the case may have been terminated by death, or the removal of the patient from the house, and in such case he may give a permit as soon as the house shall have been fumigated.

"5. A suitable person shall be employed by the board to take charge of disinfection and fumigation, under orders from the health inspector. He shall visit houses infected with contagious diseases, and instruct the family in the methods of disinfection. At the termination of the case he shall disinfect the house or the room infected.

"6. Exposure of the corpse, or a public funeral, is forbidden under a penalty of $50."

Under these rules the following plan is pursued:

Notice from the attending physician being received, the name, age,

and address of the patient are entered in a book kept for that purpose. If the patient, or any person in the family, is a pupil at any school, the principal is immediately communicated with by telephone, and all members of the family, and in many instances all children in the house, are excluded from school. The health officer then visits the house, or communicates with the attending physician, as may in his judgment suffice. The circular of the board giving instructions as to the contagious nature of the disease is sent to the house. In case of death or recovery the house is disinfected. When the proper time has elapsed, a permit is given allowing children to resume attendance at school.

This plan has been pretty closely followed, but it is doubtful whether it has served to check the spread of scarlet fever and diphtheria. We have to combat both carelessness and ignorance, and until we have a hospital to which cases may be sent we shall not be able to stamp out or limit the spread of these diseases.

When we shall educate people up to the knowledge that scarlet fever and diphtheria are as dangerous as, and kill more than, small-pox, and when we shall have pursued the same course as we do with the latter disease, then we shall be enabled to make some headway in stamping out the two other diseases.

Besides these rules the board has adopted ordinances requiring physicians to report cases of contagious or infectious diseases under their care. In consideration of the trouble taken by the physician the board allows a fee of twenty-five cents for each case reported. This fee is of course merely a recognition of the fact that a physician is entitled to compensation for services rendered, and is, I think, the first time that this has been allowed in the United States. While we have had no case of refusal to report cases, this fee is rarely claimed, and the board has been compelled in many instances to make out the account due the doctor, and to ask him to come and collect it. We have heard nothing of the rights of physicians or patients being invaded by the action of the board, or by the visits of the inspector, this exaggerated feeling being confined apparently to the English journals.

I submit this report with all diffidence, knowing well that there is nothing very novel in it. The methods laid down are old, and are employed in many of our larger cities ; but it will do no harm to restate facts, and to urge on our health authorities the necessity of trying to limit the spread of the common contagious diseases.

II.

ON THE MANAGEMENT OF EPIDEMICS IN THE CITY OF CHARLESTON, S. C., WITH ILLUSTRATED CASES.

By H. B. Horlbeck, M.D., City Registrar and Secretary of Board of Health.

Charleston, S. C., August 13, 1884.

A. N. Bell, M.D., *Chairman, etc.:*

Dear Doctor: In compliance with your request in reference to the consideration of the management of epidemics, I send you a report of eight cases of small-pox, occurring in Charleston in 1881, from five different places in the city. Vaccination, and the most rigid measures, with no uncertain hand, were used on each occasion at each infecting centre, and the patients immediately removed to the small-pox hospital, which is admirably situated for isolation, it being upon an island connected to the main by a causeway quite narrow. A guard was kept on duty night and day. Fire, wherever possible, and concentrated sulphur fumes, together with disinfecting solutions, were used.

I have no new measures to suggest as to the management of epidemics, further than to think that the means of repression and stamping out are not sufficiently known and used by the members of the profession generally, whose duty is bounded by the relief of the patient. The education of the people, by constant supplies of clearly written and condensely expressed circulars, never more than one page, containing formula of disinfectants, with method of application, is the strongest vehicle which we possess, in my opinion. When it is taken into consideration that this outbreak of small-pox occurred among a population in every sense fitted for the reception of the contagion and its propagation, the lesson taught is that the disease can be kept in abeyance, and eradicated.

In Charleston every case of diphtheria, scarlet fever, malignant measles, cholera, small-pox, and typhoid fever is necessitated to be reported at this office. The health detective immediately visits, makes a written report, and a thorough policing of the premises is instituted. Sulphur fumes, carbolic acid, copperas water, chloride of lime, and solutions of bichloride of mercury are used as necessary with isolation and cleanliness.

Report of Small-pox in Charleston, S. C., 1881.

Case 1.—S. L., col. male, aged 19. Admitted into S. P. hospital April 26, 1881; "variola discreta;" native of Charleston, S. C.; had never been vaccinated; discharged cured.

Case 2.—I. O., col. male, aged 8 mos. Admitted into S. P. hospital April 29, 1881; "variola discreta;" native of Charleston, S. C.;

had never been vaccinated; taken from same house as above; discharged cured. V. O., col. fem., mother of last case, admitted with baby; had never been vaccinated; was immediately vaccinated successfully upon admission; escaped contagion.

Case 3.—S. R., col. fem., aged 17. Admitted into S. P. hospital May 12, 1881; "varioloid;" discharged cured. This patient nursed case 1 (as parents stated that she had suffered from small-pox when an infant), and cleaned the premises after his removal.

Case 4.—H. S., col. fem., aged 7. Admitted into S. P. hospital May 16, 1881; "varioloid;" vaccinated when an infant; marks very indistinct; discharged cured.

Case 5.—J. G., col. male, aged 38. Admitted into S. P. hospital June 6, 1881; "variola confluens;" nurse in marine ward of city hospital; discharged cured three months afterwards.

Case 6.—S. A. D., col. fem., aged 7. Admitted into S. P. hospital June 11, 1881; "varioloid;" vaccinated when an infant; marks very indistinct; discharged cured.

Case 7.—N. N., col. fem., aged 4. Admitted into S. P. hospital July 24, 1881; "varioloid;" discharged cured (marks hardly perceptible).

Case 8.—W. N., col. male, aged 5. Admitted into S. P. hospital July 24, 1881; "varioloid;" discharged cured (marks hardly perceptible).

Cases 1 and 2 were from the same house. Case 3 visited and nursed case 1, but lived six or seven blocks off. Large numbers of unvaccinated persons, children and adults, lived immediately around these houses. All of them were vaccinated within forty-eight hours after the disease was diagnosed with fresh humanized virus. The clothing, bedding, etc., were removed out of the city, or burned, the rooms immediately closed until they could be (which was not many hours afterwards) thoroughly scrubbed with concentrated lye, and fumigated for at least two hours with dense fumes of sulphur. Cases 4 and 6 were from the same house, at least one mile from the other cases. Case 5 was from hospital, the back of hospital being opposite the house (across the street), where cases 4 and 6 resided. No communication was known to have been had between these places. The eruption was seen on the case in the hospital four or five days before it was recognized by the physician in charge. Very energetic measures were used as soon, however, as it was discovered. Everything that was used by the patient was immediately destroyed, or sent out of the city, all unprotected persons vaccinated, the walls washed with disinfecting lotions, and the floors scrubbed with lye. No other cases occurred in the hospital. Cases 7 and 8 were brother and sister, a mile also from any of the other cases, and no communication between them and any of the others could be traced.

III.

QUARANTINE IN ITS RELATION TO YELLOW FEVER AND THE COMMERCE OF NEW ORLEANS WITH WEST INDIAN, MEXICAN, CENTRAL, AND SOUTH AMERICAN STATES.

By Dr. JOSEPH HOLT, President of Louisiana Board of Health.

Representing the Louisiana State Board of Health, and in accordance with your request, I submit the following exposition of the inquiry contained in the above caption. The subject of this paper may be introduced by a declaration in which is epitomized the entire quarantine-commercial problem. A detention in quarantine of ten, twenty, or forty days, or an embargo through a proclamation of non-intercourse, is incompatible with commercial economy. Such interruption, extending over a period of five or six months, and repeated annually, is destructive. The shipper or consignee, the owner or charterer, of a vessel, particularly of a steamer laden with merchandise more or less perishable, and representing many thousands of dollars, cannot afford to abide the idle anchorage of his ship during a conventional period of many days, weeks, or months. Neither energy nor the investment of capital can improve trade opposed by such obstacles. A maritime port which shuts its gate against certain vast regions of commercial production cannot maintain successfully its business relations in a contest with bold and vigorous rivals in the same fields—rivals whose gates are always open, and who are ever ready to expend millions, if necessary, to insure unobstructed entry.

These affirmations must carry conviction to the mind that quarantine is, in truth, the point upon which is pivoted the commercial destiny of New Orleans. She will always transact a heavy factorage business; but we now speak in behalf of the entire scope of her commerce, and for her merchants.

In this report we will refer to the prevailing quarantine as the present or old system, condemned by the state board of health, and to be supplanted next spring by the new, presently to be described. We must treat of it, in order to comprehend the decline of commerce due to its antagonism, and to appreciate the necessity of an immediate change.

The quarantine system of Louisiana is essentially the same as that enforced in the maritime ports of all the enlightened countries of the world. Such differences as may exist refer only to points of minor detail. Its virtue, and, therefore, main reliance, is detention, while sanitation, in the true signification of the term, occupies a secondary and usually inconspicuous place.

In guarding against yellow fever, the ports of the north Atlantic seaboard can well afford to take advantage of their higher latitude, and abbreviate the term of detention so as not to interfere seriously with ocean lines of Southern trade, while New Orleans, because of exposure from

geographical position, particularly her proximity to the Mexican gulf, has been compelled to extend the period of detention, lengthening it whenever danger seemed imminent.

The present system of quarantine was adopted in this state in the year 1821. At the earnest solicitation of the people it was discontinued by legislative act in 1825, because of the occurrence of fearful epidemics of yellow fever twice in three years of its rigid enforcement. It was the unanimous sentiment that quarantine had failed to protect against this pestilence, and was destroying commerce. Reëstablished in 1855, it has continued to the present time, with a record of epidemics of cholera and of yellow fever time and again during its maintenance.

The lessons of its inefficiency have compelled the board of health to extend the period of detention ten, twenty, forty days, and even to declare absolute non-intercourse,—virtually an abandonment of quarantine and a declaration of loss of faith in the system. Under its destructive influence, West Indian, Mexican, Central and South American trade with this port, and, correspondingly, our domestic trade, have languished—in many branches have become extinct.

Looking to the future, a continuance of the present system must necessitate a repetition of proclamations as closely approximating non-intercourse as can be attained within the limit of law, however contrary to the spirit of progress and of international usage, or even of treaty. Its protective power is manifested only as it approaches non-intercourse, and self-preservation is a "higher law." This is the apology.

To what extent yellow fever and the fear of yellow fever have retarded and actually destroyed the tropical commerce of this city, and have held back New Orleans in its growth, in every department of industry, in the race with rival cities, we can hardly imagine. It is reasonable to believe that but for this New Orleans would to-day extend in compact mass from river to lake, a city of at least a million of inhabitants, hardly second, in commercial greatness and accumulated wealth, to any on this continent, and in the boldness and enterprise of her merchants, second to none in the world. But to what extent has quarantine kept out the pestilence? In reply, permit me to quote from an address I had the honor of delivering on this subject:

"Let us now examine this question, and determine how far this system is a quarantine against the importation of pestilence and against the importation of the commodities of commerce. I present here an exhibit of the prevalence of yellow fever in New Orleans during the last fifteen years, quarantine prevailing all the while. This table is compiled from the official records in the office of the board of health.

Years.	Cases.	Deaths.
1869	9	3
1870	....	587
1871	114	54
1872	83	39
1873	1288	226

1874	20	11
1875	100	61
1876	83	42
1877	1	1
1878	....	4046
1879	48	19
1880	....	2
1881	....	....
1882	....	4
1883	1	*1
Total		5096"

I present these figures as extremely interesting, and, as to our system of quarantine, finally convincing. Here is a failure twelve times out of a possible fifteen. If our quarantine system were a man at a shooting-match, and he were to make such a score, his gun would be taken from him, and he would be driven ignominiously from the field.

As straws show the direction of the wind, let us briefly cite a few instances of the effect of our quarantine upon commerce, and note the imports of coffee to New Orleans from all sources during the years 1859, 1870, 1880, and 1883:

Years.	Bags.
1859	408,396
1870	139,742
1880	249,674
1883	260,145

In 1859 New Orleans received about one half the total import of coffee grown in the western hemisphere; in 1883, a little less than one tenth. The exports to Cuba for the same four years were,—

	Bacon—casks.	Lard—tierces.	Corn—bushels.
1859	2,130	20,890	....
1870	707	4,063	124,147
1880	.....	200	156,144
1883	20	369	48,636

This table is a feeble and most imperfect exposition of the magnitude of our commercial loss. The aggregate amounts to millions and millions of dollars.

Per contra, and as an illustration of the possibilities of our commercial development, we present herewith a table showing the growth in the single trifling item of inter-tropical fruit within five and a half years under a policy of exceptional leniency on the part of the board of health. The table shows the value of fruits imported through New Orleans from June 1, 1878, to December 31, 1883.

* The death on the 7th of November, 1883, occurred after quarantine had ceased.

Years.	Oranges, limes, lemons.	Bananas.	Pineapples.	Cocoanuts.	Totals.
1878	$44,631	$43,220	$2,730	$42,561	$133,142
1879	179,927	50,159	1,279	56,155	287,560
1880	194,841	89,564	1,474	81,892	367,771
1881	310,476	108,580	2,421	85,135	506,612
1882	396,654	192,037	1,467	79,543	669,701
1883	608,406	206,506	4,779	100,479	920,170
Totals	$1,734,975	$690,066	$13,650	$445,765	$2,884,456

Here is a rate of increase from $133,142 to $920,170, and a showing for the present year of fifty per cent. on the latter. If New Orleans can afford to throw these things away, she can afford to die.

The great ports of the Atlantic coast are bidding high for all the Mexican, Central American, West Indian, and South American trade. The cities of St. Louis, Cincinnati, and Chicago, on the great trans-continental lines, perceiving the embarrassment of our Gulf ports, have boldly projected their grand international lines into the heart of Mexico. We are flanked by competition on the east, by competition on the west,—successful competition,—while New Orleans is stranded high and dry upon a bar of quarantine. The trans-continental lines of railway, and their terminal ports of the East, are exceedingly jealous of every port of entry of the Gulf states. They regard with intense disfavor any attempt to direct in its natural channels toward us a part of that inter-tropical American trade, which they know to be richer than that of India and the islands of the East, and not second to that of China. They secretly rejoice in the ignorance of some of our superficial economists, who flippantly dispose of our tropical trade as a few bananas, some pineapples, and a few bags of coffee,—a commerce which is only in its inception, as compared with its future magnitude, but is even now crowding the ports of Liverpool, Havre, and New York with the richest products of the earth,—the commerce of regions which more than two hundred years ago wrecked in a flood of gold the kingdom of Spain.

To enter this field in competition, our states must have an equal chance with others. How disastrous, then, that system of quarantine which compels their boards of health, while earnestly endeavoring to keep out pestilence, also to suspend their commerce five months out of the twelve—a system which compels the conservators of the public health to become destroyers of the public livelihood by a coalition with a rival combination, overwhelming in power and advantage.

Look upon the map, and you will see that the Gulf ports are central between four vast continents, and nearest to the West Indies. They

command by geographical position the most favored regions of the globe. Already the busy hands of capital are dividing with canal and spanning with railway the isthmuses of Panama and Tehuantepec, so that continents beyond may become tributary to these ports. This city is geographically central; but what is it in the commercial world? It has been plucked from the centre and placed down on the lower edge. An inefficient quarantine has struck across the face of this grand field a line, called the Tropic of Cancer, and has said to this city, "Thus far shalt thou go, and no farther."

The genius of man may project vast enterprises; it may cut canals, build marine railroads, jetty the Mississippi river, deepen harbors, establish exchanges. Genius and energy may accomplish all this, but will never establish in the Gulf ports of the Southern states a commerce upon a solid foundation until municipal authorities and the people at large recognize at its true commercial value the principle of sanitation, and apply themselves earnestly and vigorously to a reformation in the methods of cleansing and purifying their cities, and until boards of health no longer go to war and cease to inflict arbitrary measures, declaring embargoes upon trade as the only remedy for their own deficiencies.

A physical bar obstructing the mouth of the Mississippi presented itself for years as a formidable obstacle to the commerce of the Mississippi. The genius of Eads displayed before congress a plan whereby this bar could be jettied, and an opening made to the commerce of the world. Congress, upon mere faith in his plans, appropriated, subject to his call, $5,000,000, and to-day the mouth of the Mississippi is open to the heaviest tonnage of the maritime world. But now that the genius of man has overcome this physical bar, our commerce is confronted by a legal barrier more obstructive, more insuperable, than a physical detention. Of what use is the removal of a sand-bar of uncertain obstruction, when there remains one imposed by law, more obdurate than rock? The necessities of our very existence as a commercial people demand that we shall jetty our quarantine, and limit it to a sharp narrow channel, obstructive to importation of pestilence, but open as a highway to commerce.

Mr. Lesseps, the shrewdest commercial calculator of the world, has assured us that the Panama canal will be opened four months anterior to 1888. He has declared also that 6,000,000 of tons will pass either way through this canal the first year. The Tehuantepec railway will be opened to trade. The great tide of commerce will presently pass into the Gulf of Mexico. Its natural direction will be toward the interior of this continent by way of New Orleans. These gigantic enterprises are esteemed works of moderate cost compared to the inconceivable value of the commerce they will control.

But what is this to New Orleans?—to this great water-way, the Mississippi?—to these radiating trunk lines of railway crossing isothermal lines, with a view to the interchange of Northern and Southern products,—if the currents of trade are opposed by a quarantine of detention? A quarantine of ten days as effectually destroys commerce, eventually, as

non-intercourse. The only difference is one of a force slowly or quickly applied. Director-General Burke, in a speech before the people of New Orleans, urged the importance of the Exposition as the medium of inviting to this state the commerce of those vast regions south of us. He pointed to a huge map of the world, and indicated on it the great lines of trade with Mexico, the West Indies, the east and west coasts of South America, Japan, China, Australia, the Panama canal, the Tehuantepec railroad,—all of this commerce through a hundred channels converging into one mighty current, like the Gulf stream pouring into the Caribbean sea and Mexican gulf, to sweep through Eads's jetties towards the heart of the continent. This concentration from every quarter of the globe is the grand achievement to be hastened by the Exposition. These possibilities are all true, but the director-general would have chilled his audience if he had gone on to tell about ten days' and forty days' detention in quarantine of a ship from Japan, via the port of Colon. The great benefits of the Exposition in that direction will be a failure, if we are to block this port with a ten days quarantine after the first day of May next. It is essential that the state shall jetty the quarantine in order to realize the possibilities of the Exposition. Without this, the appropriation, national and state, of vast sums of money, is that much treasure thrown away.

There are three natural laws governing commerce, profound and invariable, more persistently operative than international or local regulations:

1. The currents of trade seek the shortest course.

2. It is a law of commerce as of fluids, to follow the course of least resistance.

3. With increase of the distance traversed there must be increased assurance of unobstructed entry.

You cannot declare ten days' detention against a vessel which has winged her way from Hong-Kong, across the vast expanse of the Pacific, via Colon, through the Gulf, and swoops into the jetties like a huge albatross utterly weary with flight, seeking rest and comfort. We might detain one, but would certainly never have the opportunity of practising our quarantine on a second vessel of that line.

The people of this state, while rightfully resisting a discriminating and mischievous interference through any illy planned national bureau or national board of health, are by no means the only ones vitally concerned in this affair. Holding the keys as janitor at the gateway of the great valley of the Mississippi, Louisiana is compelled by every obligation to recognize the importance of her trust. She can no longer bolt and double-bar these doors six months out of the twelve with an antiquated quarantine of detention, when it is optional, through a scientific sanitation, to fling open the entry of this national highway, this inland sea, to the unobstructed ingress and egress of all who may apply. The interior states of this continent have a natural right in every question touching the navigation of the Mississippi, from its head waters to the

Gulf. They have a right to free pasturage in the commercial fields beyond. This claim is supreme, and one we must heartily allow.

Viewed from any point of observation, whether from that of humanity or of science, whether from that of the grand future of commerce with our exterior or of interior connections, the solution of this question is the most important and absolutely imperative that can engage the attention of the scientists, the statesmen, or the merchants of the Gulf states and the Mississippi valley. We occupy a position of responsibility, and are no longer justified in continuing an experiment which has failed to accomplish the good reasonably demanded, while it has wrought incalculable mischief. We are obliged to change our system of quarantine, if for no other reason than to protect ourselves from cholera and yellow fever. How much the more when, by so doing, we foster our commerce, and are saved alike from pestilence and famine! We are compelled to cease this vacillation, and must recognize the fact that a ship detained ten days, or sixty days, is no more a healthy vessel at the end of that time than she was at the beginning. If she is sick, we are the physicians, and must treat her. Medicinal sanitation is the remedy. It offers the only solution wherein may be harmonized the necessities of commerce with a stronger guaranty against the importation of pestilence.

To offer a positive assurance of the infallibility of any system or precaution whatsoever, not excepting non-intercourse, is impossible. As declared by Sir Sherston Baker,—"In practice, the ideal in quarantine can never be attained. *Absolute isolation* of a community is only practicable in a very restricted degree. * * * * In practice, quarantine measures, be they what they may, can never give an absolute but only a relative guaranty of safety. We must be content, therefore, with the best relative certainty." He then cites the fire department, railway signalling, and the police force as indispensable, and not to be abolished because conflagrations, railroad accidents, and burglaries occur.

The board of health of the state of Louisiana proposes that on and after the first day of May, 1885, the effete and ruinous system of quarantine detention shall be replaced by one of sanitation. Aided by the state, it is bending its energies to the accomplishment of this great work.

The new system contemplates the detention of a ship only so many hours as may be required to cleanse her by the aid of powerful appliances, as speedily as it can be effected. The time will vary from ten hours to two or three days, according to the size of vessel, nature of cargo, sanitary condition, and probability or not of special danger. The plans, as perfected in detail, have necessitated the invention of an apparatus whereby germ-destroying gases, evolved with great energy, are driven with immense force into the intimate structure of a ship's hold, after the latter has been thoroughly washed by a steam power force-pump. The decks, ballast, and all such parts as are usually treated with carbolic acid or other disinfectant fluids, objectionable on account of odor, staining, or inefficiency, will be subjected to the action of an odorless, colorless solution of the bi-chloride of mercury, the most powerful and unsparing germicidal agent known.

This was adopted for the first time in quarantine service last summer, in the stations of this state, and has since been introduced into other important stations of this country. There is no danger to be apprehended, except from drinking the solution, which is true of every other agent used. Its cost is about eighty per cent. cheaper than crude carbolic acid. Our standard solution is six ounces, with a like quantity of muriate of ammonia, dissolved in a half gallon of water, and added to forty gallons of the latter. Salt water is also a solvent.

The practical working of the quarantine will be as follows: In order to isolate vessels actually infected, that they may not spread contagion to other vessels or to the inhabited shore, a lower or supplemental quarantine station will be established in Pass-à-L'Outre, an unused outlet of the Mississippi. Withdrawn from the track of commerce, the sick will be cared for in hospital, the vessel subjected to thorough and repeated sanitation, and detained until in the opinion of the board of health she may be allowed to proceed to the city. Her case is exceptional, and must be dealt with exceptionally. With such a station at this time we could regard almost with indifference the entry of a cholera-infected ship into the Mississippi.

The upper or general station, twenty-eight miles nearer the city, is the one now in use. When a vessel arrives from a port against which quarantine precautions are required, she is brought alongside the wharf, where she finds every arrangement for the rapid discharging and reloading of cargo, if required. All on board, officers, crew, and passengers, with their effects, are at once taken ashore, where, in a room provided, everything they carry, apparel and baggage, is subjected to powerful disinfection. All clothing, and articles that will admit of it, will be laundered, and in this process subjected to boiling water and the hot iron. The clothing worn is presently exchanged for other already treated, and this in turn disinfected. The passengers and crew will be received in commodious quarters, comfortably prepared for them, there to undergo the prescribed detention for observation of from three to five days, according to circumstances of the possibility of their being infected with the disease in its incubatory stage. If one should fall ill, he is at once removed to a properly isolated hospital, distantly located.

Hospital experience proves that yellow fever is conveyed through the medium, not of persons, but of things. These will be systematically disinfected. Yellow fever has never invaded the Charity Hospital, except in the regular march of an epidemic. The period of observation concluded without evidences of infection, these people will be sent to the city on the first upward bound vessel, to go their way or rejoin their ship as the case may be.

In order not to impair insurance or the terms of a charter party, the chief officer, and, in the case of a steamship, such persons as are actually required to handle her, after having had all clothing and baggage thoroughly disinfected, will be allowed to come up to the city with their ship. In port they will be under the constant surveillance of the health

authorities; so that, if the disease should manifest itself in their persons, or they fall suspiciously ill, the ship shall be remanded instantly to quarantine.

The first division of the new system provides for the supplemental station for infected vessels only. The second, for the management of persons arriving at the upper or regular station. These having been described, there remains to be considered the third, for the sanitary treatment of cargo and ship.

As soon as a vessel arrives in quarantine and has put ashore all persons, as previously mentioned, she is boarded by a full corps of acclimated stevedores, who engage immediately in breaking out the cargo and transferring as much of it as may be necessary to the warehouse, already built by the United States government for that accommodation, or directly into barges, as in the case of coffee, there to undergo positive treatment. As soon as completely emptied, or at least sufficiently so to permit thorough cleansing and fumigation, the quarantine tug, a compactly built, small vessel, somewhat after the fashion of a fire tug for harbor protection, is run alongside the ship. A hose, attached to a powerful forcing pump aboard the tug, is let through the forward hatchway down into the hold.

In order to flush the bilge quickly, it might be necessary to take up the limber plank, as a better examination could be had and the real condition ascertained. But whether this is done or not, or the ship be in ballast or not, she can be speedily and thoroughly washed. The pump is started and the washing begins while the ship's pumps are set to discharging the foul bilgewater. This continues until she is washed clean, not only in the limbers and floors of the hold, but the ceiling and every available part. She is now pumped out, the hose removed, and then begin the disinfection and fumigation. Another large hose, attached to a powerful exhaust fan, is lowered into the same position as the first. The hatches and every other outlet are closely battened, with the exception of a small ventilating hatchway, either at the bow or stern. A quantity of sulphur is put into the furnace connected with the fan, and ignited. The exhaust fan is started, and sulphurous acid gas in immense volume and with tremendous force is driven into the limbers and air-strakes, into every crevice and part of that ship, until she is completely filled. We go through her with an atmosphere, as it were, of fire.

In doing this we displace the mephitic and dangerous atmosphere, closed in her when she started from Rio, we will suppose, and which, if allowed would have been set free at our levee—the infected atmosphere of Rio to commingle with the atmosphere of New Orleans, deadly ripe, perhaps, for its reception. We have displaced this not only with a non-infected atmosphere, but with one intensely germicidal, one that destroys organic elements in the air, or on exposed surfaces, with instant greediness. As for the fumigating agent to be selected, we may use, through this apparatus, sulphurous acid gas, chlorine, or the nitrous acid fumes, produced by pouring nitric acid upon copper filings, of which Dr. Wiblin, of Southampton, says that all the goods may be safely and satisfacto-

rily disinfected by this agent. The fumes so produced are so powerful that no animalculæ can exist in them for more than two seconds, and the portholes being closed for twelve hours, the process cannot fail to be effective. For my own part, I believe that the sulphurous acid is all that we can desire.

The apparatus referred to as invented for this special work consists of a battery of nine small furnaces, opening into a receiving chest or reservoir, from whence the exhaust fan, directly attached, draws its supply of the gaseous germicide. It is capable of receiving ninety pounds of sulphur at a single charge.

After a few hours the hatches are removed, and pure air is driven in to facilitate clearing the ship of fumes. She is reloaded, or her freight already sent by barge, and with her captain on board, proceeds at once to the city, there to be discharged only by an acclimated gang. Her export freights must be ready. She is at once reloaded and starts on her voyage. If the term of detention of her crew has not already expired, she touches at quarantine to take on such as have engaged to reship, and puts to sea, with no more detention than was required to cleanse her with the utmost expedition, which alone was worth the trouble. Such a method would soon be adopted at tropical ports before leaving, which would greatly lessen the danger and facilitate our work.

This general plan, with its specifications, as exhibited, constitutes the new system of quarantine. Having once been enforced, we may boldly proclaim that for the first time in the history of quarantine, a ship has been actually cleansed, disinfected, purged of suspicion, by appliances adequate to the work. Against such a vessel there remains no cause of accusation. Let her go free, and land her boldly along these wharves!

The plan of improving quarantine methods must cost money. Suppose it cost \$20,000 or \$60,000: what is that compared with the value of the unobstructed commerce of a great centre, sweeping the circle of the world for trade? If it improve the guaranties against importation of pestilence, what is that amount as compared with the blessing shed upon the cities of the Gulf and the millions of people behind us? To prevent the introduction of yellow fever, one single year would justify a thousand times the expenditure.

In estimating the cost of the new, we must first consider how much we pay for the old. The experience of others may help us to understand our own case. From the *Pall Mall Gazette*, of a recent date, I quote the following:

WHAT CHOLERA QUARANTINES HAVE COST.

It will be a nice problem for the statisticians presently to determine what the latest visitation of cholera in Europe has cost. A week or two ago it was calculated that the quarantine had already resulted in a loss of £1,600,000 to the Italian revenue, and now the Spaniards have begun counting their bill of costs. The falling off in customs since quarantine was established had amounted by the end of August to close upon £250,000, while the value of the exports and imports during the same period had shown a decrease of £675,000. No wonder that the corporations of Madrid and Barcelona have petitioned the government to take these facts into consideration. The Minister of Finance, finding

that the equilibrium of his budget was being seriously disturbed, has persuaded his colleagues that it is time to have done with the quarantine craze, and with the beginning of the present month the regulations have accordingly been relaxed.

While the North Atlantic seaports may enjoy peculiar privileges and exercise a certain boldness in regard to yellow fever, due to the exemption afforded by high latitude, there is not one so equipped in its quarantine service as to allow, with serenity, the reception of a ship with passengers and crew dying of cholera. Nay, more. There is not one but would be thrown into an agony of anxiety or downright terror by such an occurrence. Confidence in their protective regulations is inverse to the degree of danger threatened.

In order still further to diminish the risks and to facilitate quarantine sanitation, the national government has been applied to, with a view of establishing in all foreign ports, from whence pestilential diseases might be introduced, consular agents, whose duty it shall be to see that all vessels clearing for the United States shall be in a perfect sanitary condition before taking in cargo and at the moment of departure. They shall also certify to the number and health of all on board, and to the health and sanitary condition of the ports in which they are located.

I quote from the valuable letter of a late member of this board, Colonel Walter M. Smallwood (deceased), read before the conference of boards of health of the Gulf states and Tennessee, held in this city last June:

> The best method of quarantine sanitation should begin its work at the port of departure, and be completed at the port of entry, to include approved methods of ship sanitation, under competent authority, pending the voyage of a vessel from one port to another. The hazards of importation of infectious diseases would certainly be immensely reduced if there could be a guaranty that all vessels loading in foreign countries for ports in the United States are thoroughly cleansed and rendered non-infected before being allowed to receive their cargoes. It will readily be perceived how such a system of international sanitation, by preventing the shipments and exportation of disease, would insure safety and promote commerce.

The new system of maritime sanitation was heartily endorsed by the conference above mentioned, and by the commercial exchanges of New Orleans. The general assembly of the state has emphasized its approval by an appropriation of $30,000. Governor Samuel D. McEnery has throughout zealously promoted the purposes of the state board of health. The press has ably seconded and sustained the effort.

The general government, through its treasury and war departments, has graciously allowed the use of the large warehouse at the upper station, and of land for the location of the supplemental quarantine. It has also permitted the able engineer, Col. John W. Glynn, U. S. Supervising Architect, to give his professional services to a cause affecting the states of the Gulf and the entire Mississippi valley. Earnestly interested in the public behalf, and familiar with every detail of this comprehensive question, there is no one more eminently competent to render services of the highest order.

The people of Louisiana are thoroughly alive to every particular affecting the improvement of their commercial relations, and the state board of health is profoundly conscious of the responsible trust imposed upon it; and I close this paper with the uncompromising assertion that sanitation, maritime and municipal, furnishes the only protection against the importation and spread of cholera and yellow fever worthy of respect and confidence. If this fails, having been scientifically applied, human power is at an end.

IV.

It is my privilege to add the following in connection with my own recent practice, as reported by my colleagues:

MANAGEMENT OF MEASLES, WHOOPING COUGH, AND DIPHTHERIA.

By GEORGE B. FOWLER, M. D., Visiting Physician N. Y. Infant Asylum.

11 West 45th St., N. Y., October 11, 1884.

A. N. Bell, M. D.:

My Dear Doctor: I cheerfully comply with your request for my view of the value of the hygienic measures instituted by you at the country home of the New York infant asylum, during the prevalence of a most severe epidemic of whooping cough, measles, and diphtheria during the summer and autumn of 1883.

The home is situated in the town of East Chester, Westchester county, upon an elevated and attractive plot. It consists of a large main building and five outlying cottages, besides an old residence. With the exception of this last, each house was constructed under careful supervision to meet the wants and emergencies natural to an institution devoted to the care of women and children.

Early in July, when the inmates numbered about 320 (223 children, 97 women), whooping cough began to prevail, and soon after a case of measles appeared in a ward of the main building. Without going into details (which I have done in another place), suffice it to say that, despite the efforts of resident officers and visiting physicians, the diseases spread from child to child, and very soon an epidemic was prevalent. In harmony with the generally recognized fact that the acute infectious diseases of children are very closely associated, and liable to follow each other, we in a very short time discovered several cases of diphtheria. When it is remembered that, as a general rule, those children attacked by one disease were either suffering from another, or just convalescing, and taking into consideration the peculiarly malignant type of measles which prevailed, its tendency to repeated relapses, and the universal prevalence of severe pulmonary, brain, and bowel complications, some conception may be formed of the conditions with which we had to cope.

On account of the triple character of the epidemic, and the fact that in

frequent instances a child would be suffering from two, or even three, diseases, the difficulties in the way of successful isolation were very great; for there were twelve classes of children to be kept separate,—1, measles; 2, measles with whooping cough; 3, whooping cough; 4, convalescent measles; 5, doubtful whooping cough; 6, doubtful measles; 7, those who have been exposed to measles; 8, those exposed to whooping cough; 9, diphtheria; 10, doubtful diphtheria; 11, whooping cough with diphtheria; 12, healthy children. However accurately this division might have been made at any one time, it is evident that the appearance of either of the prevailing affections in an isolated colony hitherto free from it would instantly upset the entire arrangement, and necessitate another division; and thus it frequently happened to us. To have successfully carried out quarantine and isolation, a more expensive premises and a greater number of assistants than were at our command, or that of any similar institution, would have been necessary.

Under your orders and immediate supervision, very energetic measures were instituted looking toward thorough disinfection, and as complete isolation as possible under the circumstances. I have no doubt but that had your specific directions been followed from the first, the epidemic would have been of shorter duration and of milder type; but, on account of an unfortunate misunderstanding and conflict of authority, the separate wards were subjected to the fumes of a small quantity of sulphur, which proved ineffective. When your orders were strictly carried out, the entire house or cottage being vacated by the inmates, the bedding, clothing, and utensils only remaining, the fire-places, windows, and outside doors closed and sealed, the communicating doors left open, and several hundreds of pounds of sulphur burned, disinfection was accomplished. This process was repeated several times from house to house, with a continued round of vacating and reoccupancy, and the diseases immediately ceased to prevail, and have not since reappeared. During the height of the epidemic, we had, at your suggestion, recourse to tents in which to place our diphtheria cases and their isolated nurses. In my opinion, properly constructed tents, such as were used on this occasion, offer the best possible means of treating infectious diseases, in that the ventilation is perfect and constant, and, under proper care, draughts are impossible. The manifest improvement in our cases, thus housed or tented, maintained this well established fact. In conclusion, let me add, that I am convinced that the practice which you have instituted at the institution of a systematic and thorough fumigation with sulphur of every cottage once every two weeks, as a measure of purification and protection, has mainly contributed to the health of the inmates during the past year.

V.

ON THE MANAGEMENT OF PUERPERAL FEVER.

By J. CLARK THOMAS, M.D., Visiting Physician Lying-in Department N. Y. Infant Asylum.

107 West 47th St., New York, October 9, 1884.

Dear Dr. Bell: Your letter, requesting of me an account of the management of the epidemic of puerperal fever that so unfortunately visited the city branch of the New York infant aslyum last January and February, was duly received. If the reply is too extensive, my plea is, the subject cannot be treated at the same time briefly and justly.

The medical management of this institution, in the early part of 1883, was vested in a new medical board of men eminent in the various departments to which they were assigned. This board, through its executive committee, of which we were both members, inspected thoroughly every part of this branch. We found much to condemn in the defective ventilation, heating, and plumbing. In our report to the board of managers, these defects were pointed out, and the proper methods of remedying them plainly indicated; but the occurrence of a peculiar and malignant epidemic of measles at the country branch of this institution in the ensuing August, September, and October, and the more pressing need of sanitary improvements there, absorbed all funds applicable for repairs. The beginning of 1884, therefore, found the sanitary defects of the city branch nearly the same as at the inception of our service. The natural outlet of the city branch being closed, by reason of the epidemic at the country branch, its capacity was tested to an extreme degree. Rather than close the institution's doors to applicants for reception, a neighboring building was temporarily secured, furnished with all necessaries, and filled with waiting women, and a few women with their children. Its cellar was damp and uncemented. Its general ventilation was poor. It was, however, the best that could be secured in the emergency.

In April, 1883, at the beginning of my obstetric service, I addressed you the following note:

Doctor A. N. Bell:—May I request you, as the sanitarian of the New York Infant Asylum, to make an official inspection in the interests of the obstetrical department?

It is desired that you examine especially,—

(*a*) The wards in use for first weeks of convalescence from the puerperal state.

(*b*) The bedding—its character, and the present method of disinfection and cleansing.

(*c*) The wards in use for the last weeks of puerperal convalescence.

(*d*) The apartments occupied by the waiting women.

(*e*) As to the disposition of the secundines, etc.

Any suggestions you may have to make, as the result of your examinations, are especially desired. They are requested as to,—

(*a*) The selection of a permanent apartment for the purpose of accouchement.

(*b*) The selection of wards to be used, alternately, for the first week of puerperal convalescence.

(*c*) The selection of wards for the latter weeks of puerperal convalescence.
(*d*) The safest and most reliable disinfectant for obstetric use.
(*e*) The best (and safest) character of bedding for the puerperal convalescence.
(*f*) The protection of bedding during the puerperal convalescence.

* * * * * * * * * * * * * * *

If any change is to be made in the existing order of affairs in the obstetric department during my service, it shall be only for the best of reasons. Any such change shall be made in the most thorough manner. Very truly yours,

J. C. THOMAS.

New York, April 2, 1883.

You promptly made the inspection, and indicated certain wards as being the best fitted and located for obstetric use. You advised the use of Platt's solution of the chlorides as a substitute for carbolic acid, which had hitherto been used.[1] You approved of the bedding (which consisted of an iron bed with a wire-woven mattress, and two heavy army blankets, each doubled, superimposed on the mattress, and the usual sheeting and coverlets). The use of rubber-sheet protection for the bedding you did not approve.

I concurred in your views as to the wards, and as to the bedding and its protection. The use of the solution of the chlorides, in obstetric practice, I was not acquainted with. In May, 1883, its use was begun, and continued up to January 1, 1884. I was agreeably surprised at the change in the character of the resulting antisepsis, having so long depended upon carbolic acid and iodoform.

The two wards selected for the early part of puerperal convalescence were the "isolated brick building and the lower ward of the pavilion." The former is a one-story structure, erected in 1882. It is about forty-two feet in length, twenty-two feet in width, and fourteen feet in height in its interior. Its ventilation is good as to its mechanism, but to properly ventilate and heat it at the same time, with its system of steam heating, in the winter time (or the cold weather) is impossible. To effectually heat it in cold weather, the ventilators are kept closed.

Its water-closet is located in one corner, being partitioned off by vertical thin and narrow strips of tongued and grooved pin-planking. Its door opens directly into the ward. This closet has a small window, six feet from the floor, opening towards the east.

Its cellar is irregular in depth—from two feet at its northern end to five and one half feet at its southern. Seven steam-pipes ascend from it to the ward. By city ordinance, there must be one and one half inches of space around each of these pipes in their ascent through the flooring.

The lower part of the pavilion is that of a three-story brick building. It is about seventy-five feet long, twenty-three feet wide, and fifteen feet in height. Its cellar is only half of the length of the building—its eastern half. Its bottom is simply bricked, and in some limited areas cemented. Located in it are the engine, the steam-heating apparatus of

[1] Platt's chlorides consist of a saturated solution of chloride of zinc, 40 per cent.; chloride of lead, 20 per cent.; chloride of calcium, 15 per cent.; chloride of aluminum, 15 per cent.; chloride of magnesium and chloride of potassium, each 5 per cent.

this branch, the coal-bins, and a large iron water-tank. Underneath the western half of this ward is an unventilated, unlighted, and comparatively inaccessible space two feet in height. No one connected with this branch can recall the date of its last cleaning. Through the floor of this ward there ascend from the cellar seven or eight steam-heating pipes. On the northern exterior of this building a tin leader from the roof, and connected with the sewer-drains, descended near (between) the windows of this obstetrical ward. It was poorly jointed, so that emanations from said sewer-drains passed readily into the atmosphere near said windows. The ventilation of this ward is mostly by its windows. The heating is by steam. By the agency of the heat, through the spaces around the steam-heating pipes, emanations from the soil, or from decaying or vegetable matter (if allowed to collect or exist there), readily find access to each of these wards. In cold weather, efficient ventilation of these cellars means freezing of the steam-pipes.

Here, then, were the conditions that afforded a fertile soil for the propagation of septic germs,—

1. The crowded condition of this branch.
2. Defective ventilation.
3. The communication between the floors by the open spaces around the steam-heating pipes.
4. Defective plumbing.
5. In consequence of the unpreventable crowded condition of this branch, the inability to alternate in the use of these puerperal wards oftener than once in two to three weeks.

The history of the obstetric service in this branch, so far as I have been able to learn, is one of more or less frequent recurrence of a mild type of sepsis, with an occasional severe or fatal case. In my service, from April 1, 1883, to January 1, 1884, there were five or six mild cases, and one very severe but not fatal case, following operative procedure.

Up to January 1, 1884, the practice had been to employ antiseptic vaginal douches three times a day, followed by local antiseptic cleansing; to employ antiseptic cleansing of all bed and body linen; to employ daily antiseptic cleansing of the ward in use; to employ scrupulous cleanliness in every appointment of the wards, and on the part of the attendants; to employ every agency indicated in promptly combating all complications occurring during the puerperium.

Having in the past accepted the pathogenesis of puerperal infection as in great part autogeneric, the tabulated results of the pathological investigations of the leading savants (of pathology) in the old world, and their tabulated results of investigations as to the relative potency of the various germicides, and the clinical view of this infection, as taken by the obstetrical section of the British Medical Association in August, 1883,[1] effected a radical change in my pathological views of it, and indicated a

[1] *British Med. Jour.*, August 11, 1883.

rigid and thorough antisepsis for its prevention and suppression, should it appear.

In November and December, 1883, puerperal infection seemed to burst out into an epidemic in this city and its neighborhood to so marked a degree as to precipitate papers and discussions from and by our best obstetricians and savants, which excited much interest in our county medical society, academy of medicine, and the medical press, and which, in the latter, has continued even to the present time.[1]

The problem in the discussion seemed to be "how to reduce the mortality," or, rather, "the treatment," a more unattractive subject than the etiology and pathology of puerperal infection. The chief features or arguments of these essays, discussions, and medical press articles appeared to be, that there is a resulting traumatism from the passage of the child through the genital canal, and the separation of the decidua; that the principles of antiseptic wound treatment are indicated in its management; that in puerperal infection we have to deal with septic influences in the shape of certain micro-organisms, whose potency can be greatly enfeebled or destroyed by certain germicides, and thus its efficient cause removed. The minor feature or arguments were, the denial of the primary element in puerperal infection being septicæmia, and therefore of the necessity for the extreme active prophylaxis in its prevention, and its existence as a distinct disease.

With such timely warning and preparation, we were anxious lest this well dreaded infection should find access to our wards. None but the attendants were allowed to even enter an obstetrical ward. Every precaution was taken to prevent the access of this infection from without, or outburst from within, as we thought.

Our resident staff then consisted of but one, a female physician of three or four years' experience as such in the institution. In March, 1883, I presented to the medical board the urgent need of an assistant resident physician. The board created accordingly that position. It was found almost impossible to secure a suitable medical person to fill it, and January 1, 1884, found us without one.

Having decided to adopt Dr. Garrigues's method or system of antisepsis[2] as the most effective in its practical working and results, as answering the pathological and clinical indications, both as a prophylatic against the infection, and as a vigorous means of overcoming the disease, I awaited the securing of an assistant physician before fully putting it in execution or practice.

[1] Dr. T. G. Thomas, "Preventive Treatment of Puerperal Fever."—*N. Y. Medical Journal*, vol. 24, p. 703. Dr. H. G. Garrigues, "Prevention of Puerperal Infection."—*N. Y. Medical Record*, vol. 24, p. 723. Dr. F. Barker, "Prevention and Treatment of Puerperal Fever."—*Medical Record*, vol. 25, p. 170. Dr. E. L. Partridge, "Puerperal Fever: an Outline of its Nature, Manifestations, and Management."—*N. Y. Med. Journal*, vol. 29, p. 9. Dr. Simon Baruch, "Objectional Methods of Prophylaxis against Puerperal Fever."—*Med. Record*, vol. 25, p. 178. "A Plea against Prophylactic Injections after Normal Labor."—*N. Y. Medical Journal*, vol. 29, p. 12. *American, Journal of Obstetrics*, vol. 17, p. 284; *Medical Record*, vol. 24, p. 713; *Amer. Journal Obstetrics* vol. 17, pp. 674, 698, 818; *Medical News*, vol. 44, pp. 442, 467—vol. 43, p. 95; *Med. Record*, vol. 24, p. 133; *N. Y. Med. Journal*, vol. 37, p. 347.

[2] *N. Y. Med. Record*, vol. 24, p. 703.

On January 5, at midnight, a mild case of puerperal infection was recognized on the third day of puerperium. There were two other puerperal women in same ward, one of whom was in her fifth "post-partum day," the other in her sixth. The latter of these two was seized with the infection on her twelfth "post-partum day," the former on her sixth. Of these three women, the first convalesced in five days, the second in nine days, the last died on the eighth day, her case being very severe in its outset and course. These cases were in the "isolated brick building" ordinarily used as a quarantine for infectious diseases when any occurred.

On the 11th day of January the third case developed. I detected near one of the steam (heating) radiators an unpleasant odor, as of putrid animal matter. We immediately instituted a thorough examination of this ward and its cellar. In the latter a dead and putrescent rat was found.

Notwithstanding our pressing need of an assistant resident physician, we were unable to procure one. There were fourteen cases of puerperal infection developed between January 5, 1884, and February 12, 1884. There were delivered in that time fifteen women, eleven of whom became infected. Three of these died. There were four deaths in all.

During January we isolated every infected patient, and treated them all antiseptically according to Dr. Garrigues's system, except the "pad." There was rapid alternation in the use of the obstetric wards, which were always thoroughly disinfected with sulphur before being occupied.

On February 15 all the waiting women, who had been kept in the temporary annex to the institution, were transferred to the country branch.

On February 12 the obstetric service was suspended.

On February 1 I suspended the resident physician from obstetrical duty, though no assistant had been secured. Having to treat both the infected and the non-infected herself, notwithstanding the employment of the most careful and thorough antisepsis as to her person, I became convinced that she might be a carrier of infection. I assumed her duties, so far as the non-infected were concerned, for two days and nights. Having at last secured an assistant February 3, I felt more hope of staying the epidemic of infection; but in this I was disappointed, for every patient she treated became infected.

It was impossible to secure hearty coöperation from this new assistant in the details of a thorough antisepsis. As she was but a temporary assistant, I suspended the service rather than assume any further risk. In the last few patients only did I begin to use the "obstetric pad" of Dr. Garrigues. The infection spread rapidly, and so virulent was it that out of fifteen women confined during thirty-seven days, eleven were attacked and three died.

The service being suspended the entire institution was disinfected, not "fumigated," ward by ward, with fumes of sulphur—three pounds of sulphur to each one thousand cubic feet of space—all openings being carefully closed for twenty-four hours. This process of disinfection was

repeated several times. The nurses and resident physicians disinfected thoroughly all their clothing and their persons by bathing, using for the former a solution of the bichloride of mercury one to one thousand, and for the latter a saturated solution of boracic acid. The disinfection of their persons was repeated several times. The plan of antisepsis, as recommended by Dr. H. G. Garrigues, and adopted during the progress of the epidemic, was as follows:

a. Each waiting-woman, from the date of her entrance to the hour of her labor, had her general condition noted, her temperature taken and recorded daily, and her urine carefully examined each alternate day.

b. Healthy pregnant women were separated from the unhealthy so far as possible.

c. A general bath was given each woman at beginning of labor.

d. On entering the accouchement apartment the woman was bathed from her arm-pits to her knees, with "No. I solution," and a vaginal douche of "No. II solution" was given, and was repeated every four hours during labor. ("No. I solution" consisted of one thousand parts water and one part of bichloride of mercury. "No. II solution" consisted of two thousand parts of water and one part of bichloride of mercury.)

e. On approaching a patient in the delivery-room, the doctor and nurse used freely "No. I solution," soap, and a nail-brush. The doctor used "No. I solution," or a mixture of the bichloride of mercury and glycerine, as a lubricant in making digital examinations in the vagina.

f. An apron, consisting of three or four thicknesses of lint, four by nine inches, was saturated with "No. I solution," and placed over the vulva during the second stage of labor.

g. Instrumental interference was always preceded by a vaginal douche of "No. II solution," and followed by the same, and an intrauterine douche of the same.

h. No vaginal douches were used after a normal labor unless the odor of the lochia or the local conditions indicated, then only as few as possible.

i. All lacerations of the vaginal mucous surface were touched, soon after labor, with an astringent to close the mouths of the absorbents, and then coated with liquor gutta-percha to keep them closed and protected.

j. Before attending to each patient, in the shape of local ablutions or necessities, the nurse used "No. I solution," soap, and nail-brush to her hands.

k. The physician on entering and leaving a ward used "No. I solution," soap, and nail-brush.

l. A marked elevation in the temperature was an indication for immediate isolation of the patient.

m. Ten days was the limit for the use of one ward or a given ward; then it was disinfected with sulphur.

n. The floors of the ward in use were mopped up each day with a "No. I solution."

o. A separate physician and nurse were allotted the infected (as soon

as we secured an assistant, which was on Feb. 3, 1884), and they were not allowed to enter any obstetrical apartments but those occupied by the infected.

p. The "pad" was applied and renewed every six hours. This pad consisted of three thicknesses of lint four inches wide by eight inches long; this was saturated with "No. I solution," and applied over vulva; it was covered immediately by a piece of oil-silk one inch wider and one inch longer than it. These were secured by large nursery pins to the bandage in front and behind; a large pad of finely picked oakum was next applied, and this was retained *in situ* by a snugly adjusted napkin. This was applied, or rather the application of it was adopted, late in the epidemic, and a rigid test of its merits was not possible. I feel confident that it was a means of saving at least two lives.

In addition to the above was added,—

a. The spraying of wards twice daily with the steam spray, with a solution of Platt's chlorides, one part of the latter to twenty-five of water.

b. The furnishing of each bed with two covering blankets, each to be used twelve hours of each day, and thoroughly aired for six hours at least before being used again.

That the bichloride of mercury is the most reliable germicide is generally admitted by its general use. The question of its harmlessness in obstetric practice is not yet settled. In the *American Journal of Obstetrics*, vol. 17, page 935, five cases of indubitable poisoning by it are referred to. Its permanency of constitution not being stable, it may be rendered so by the addition to its solution of a little chloride of sodium.

The obstetrical service was resumed on Feb. 29, 1884, and up to Sept. 1, 1884, when my term of service expired, the health of the patients or inmates was most excellent. And for the purpose of this report the resident physician writes me:

NEW YORK, September 23, 1884.

DR. THOMAS:

Dear Doctor:—Our maternity wards were reopened February 29, 1884. From that date until September 1, 1884, there were ninety-nine deliveries. Of these patients ninety-six had a normal lying-in, or, to be more definite, everything went well with the first five patients confined. The sixth was admitted in labor March 16, 1884, with marked œdema of the lower extremities; her urine was one half albumen. On the sixth and ninth days her temperature rose to 103°: this was considered to be due rather to her general condition than partaking of a septic element. Patient convalesced satisfactorily. Discharged well April 12, 1884.

A patient was confined April 16, 1884, being the sixteenth case since the service was resumed. On her twelfth post-partum day she developed tenderness over the uterus, accompanied by pelvic pain. Temperature 102 1-5°. Lochia normal as to quantity and odor. These symptoms were relieved by treatment in two days. Patient made a good recovery.

The only well marked case of septic infection during the time specified occurred in a patient delivered of a still-born infant May 2, 1884. The girl was very anæmic upon admission, and, as I subsequently learned from the physician who had attended her, had a syphilitic history, to which undoubtedly the death of the child was due. It was much macerated, and, although an intra-uterine douche was given immediately, her temperature reached 101 2-5° on the night of her confinement. The disease was of a mild type, with-

out other symptoms than the elevation of temperature, the highest being 102½°. The temperature and pulse remained normal after May 26, 1884.

The condition of our wards at present is very good.

* * * * * * * * * * *

Yours truly, KATE PARKER, M. D.

There can be no more successful illustration of the stamping out of puerperal infection than this. That a dead and putrid *rat* was the exciting cause—the importer of the *materies morbi*, under possibly predisposing telluric and atmospheric conditions, I believe to be a fact. There were, besides, unsanitary conditions, which you, as sanitarian of the institution, corrected as well as you could, ventilated cellars underneath the wards, improved the ventilation of the drains, and had the tin leaders disconnected from the sewers. It was all you could do until the service was suspended and the wards vacated, when thorough disinfection was accomplished.

Says Dr. McClintock (*Dublin Quarterly Journal Medical Science*, vol. 19, page 456, proceedings of Dublin Obstetric Society),—"It rarely happens that puerperal fever breaks out in hospital without its contemporary appearance in private practice; and it never happens, I believe, that it prevails to any extent outside the hospital without appearing among the patients within its walls."

Says Dr. George H. Kidd ("Puerperal Fever," *N. Y. Medical Record*, vol. 26, page 146),—"But the history of great hospitals, such as Vienna or Dublin, shows that puerperal fever will prevail, and cause sad mortality at times, and disappear again, and that the conditions governing its movements have not yet been discovered."

The term "puerperal fever" I take to be a broad, a comprehensive term or name, indicating or denoting infection during the puerperium, and expressive of many varying conditions. Its pathogenesis offers a wide field for theoretical deductions, speculations, and personal opinions. Its autogeneric or heterogeneric origin, the question of its contagion, infection, or inoculability, and the extent thereof, the method of admission of the *noxa*, the infection, whether by a wound, a mucous surface denuded of epithelium, or any other method, there is no indication to discuss here.

There are certain facts, however, which, it is well to note, are admitted by all who have faithfully examined the clinical and pathological history of this disease.

1. The first fact is, that the scientific investigators have uniformly found the presence of a chain-like micro-organism in the exudations and organs of those who have died of this disease.—Carl Lomer, "Our Present Knowledge of the Relations between Micro-Organisms and Puerperal Fever," in *Amer. Jour. Obstet.*, vol. 17, page 673.

2. The second fact is, "that when in any case of puerperal fever their presence has been detected in the exudations, they have also been found in the deeper organs.—*Ibid*, page 696.

3. The third fact is, that "besides the chain-like form, other micro-

organisms have been formed in puerperal fever, *i. e.*, mixed infection."—*Ibid*, page 697.

4. The fourth fact is, that the pathologico-anatomical investigations show that puerperal fever, erysipelas, diphtheria, scarlatina, and pyæmia possess similar micro-organisms, similar in form and in their action towards fertilizing fluids and coloring matters.—*Ibid*, pages 696 and 697.

5. The fifth fact is, that clinical records present ample evidence that scarlatina, measles, typhoid fever, erysipelas, and puerperal fever have some condition in common, "that they should each and all be liable to be grafted into diphtheria.—*N. Y. Amer. Jour. Obstet.*, vol. 17, page 715.

6. The sixth fact is, that the virulence of the infecting virus increases as it is produced, therefore becoming more infective.

7. The seventh fact is, that the results of antiseptic midwifery indicate local infection.

Believing it more judicious to tabulate facts at the present time and resign their explanation to a period when we shall be more competent to reach their solution than now, we have proposed in our obstetric service to follow the indications presented by said facts, as well as those furnished by the practical experience of those who are acknowledged as competent to speak with authority.

I. The indications thus presented for the prevention of puerperal infection are,—

a. To so conduct or manage labor as to diminish the amount of injury done and violence employed.

b. To secure and maintain effective contractions of the puerperal uterus.

c. To avoid all risk of infecting the puerperal women with any contagion.

d. To maintain scrupulous cleanliness in all the appointments of the lying-in chamber, and in those in attendance upon it,—for Simon has told us that "uncleanliness is the most deadly of removable causes of disease," and Burdon Sanderson has told us that "the only scientific definition of filth is that it consists of the products of bacterial evolution."—*Medical Record*, vol. 26, page 143.

e. To secure and maintain the most approved system of ventilation of the lying-in chamber.

f. To immediately isolate, with separate attendance, every case exhibiting any evidence of infection.

g. To frequently change the lying-in ward.

h. To disinfect thoroughly and completely in every detail each ward before reoccupation.

i. To employ the most perfect system of antisepsis for the destruction of the micro-organisms found, whether they are the originators or carriers of the infection.

j. To immediately remove every exciting or predisposing cause in the surroundings.

The medical press has lately bristled with invective, wit, and sarcasm at the rigid system of antisepsis. Their batteries have seemed double-shotted. The character of the results of the application of a thorough system of antisepsis during the puerperivm enables it to endure any and every assault and still retain the support of many of our ablest and foremost investigators and teachers.

II. The indications presented for the suppression of the infection when once it has entered a lying-in hospital are,—

a. The application of every and all means of prevention for the protection of the uninfected.

b. The suspension of the obstetric service.

c. The immediate destruction of the infecting agent by thorough and repeated (at short intervals) disinfection of the entire institution and its contents, until the disease is eradicated.

Says Dr. Garrigues: "Labor is a normal process, but it is not normal to give birth to a child in a hospital. Consequently artificial surroundings call for artificial means to prevent mischief." It has been demonstrated by statistics that the price of success in the prevention and management of puerperal fever is an unremitting attention to every detail in antisepsis.

The obstetrician always considers and accurately examines all new methods in theory and practice, and weighs by the highest standards of his science the crystallized experience of the past. A satisfactory demonstration of their merits at the bar of the judgment of the profession will ensure their acceptance, and become a means to a higher and truer excellence.

VI.

THE ESSENTIAL CONDITIONS OF EPIDEMIC DISEASES, AND THE KNOWLEDGE AND MEANS NECESSARY FOR THEIR CONTROL.

To the foregoing special reports little need be added with reference to the recognized elements upon which efficient work for the control of the particular epidemics reported upon was based, or much added to show that, on the same basis, other epidemics are in like manner controllable.

The control of epidemic diseases essentially depends upon a knowledge of their existence, the conditions under which they are sustained, and the available means for their management. Hence it can hardly be regarded as any longer an open question in the United States, and certainly not in this association, that it is the first duty of every physician on recognizing a case of epidemic disease to report it to the sanitary authority. But it is the misfortune of some rare communities to have individuals in their midst who, by resistance to the practical application of this knowledge, abet and encourage the existence of epidemic diseases, under the pretext of maintaining private rights.

To meet possible obstacles, from this or any other cause, it appears to your reporter eminently proper that the duty of reporting epidemic dis-

eases, and vaccination for the prevention of small-pox, should be placed upon the same plane as all other duties which have for their object the support and promotion of the public welfare;—it should be made obligatory: *Salus populi suprema est lex.*

By the census of 1880, the number of deaths reported in the United States for the year was 756,893. Of this number, 176,693 were caused by five of the most fatal epidemic diseases, namely,—measles, 8,772; whooping-cough, 11,202; scarlatina, 16,416; enteric fever, 22,905; and diphtheria, 38,398. The number of deaths from small-pox and other less prevalent epidemics are not summarized in the census report. But from statistics which I have been able to obtain, with the kindly assistance of Dr. John T. Nagle, registrar of vital statistics, New York, and from other sources, the number of deaths from small-pox in the chief cities of the United States, for the year 1882, was 2,940; and in 1883, 1,058. Doubtless there were as many more scattered throughout the country during the same period, which were not made the subject of official report.

It is safe to estimate, that of the whole number of deaths in the United States in the census year, not less than 200,000 of them, or considerably more than one fourth, were caused by epidemic diseases. How many of those deaths might have been prevented by the prompt report of every case on its occurrence to the sanitary authority, and by the timely vaccination of all those who by that means would have been fortified against small-pox, it is, under the circumstances, impossible to know. But, probably, as measured by the known results in places exempted from the prevalence of epidemic diseases by timely vaccination, prompt notification to the sanitary authorities of all cases of epidemic diseases, and energetic measures for their prevention, if the same means were made general throughout the United States, 100,000 deaths annually would thereby be prevented.

In populous communities of civilized people everywhere, in recent years, there are various organizations under laws and ordinances for the preservation of the public peace and the protection of property. Police and fire prevention organizations exist for the arrest of thieves, highwaymen, and incendiaries; and any person detected as being privy to the acts of such depredators is justly held as *particeps criminis.* Moreover, there are United States laws for the inspection of steam boilers, for the prevention of over-crowding passenger vessels, etc., by which, doubtless, many lives are saved. But, as compared with the subject at issue, is there any member of this association, is there any person worthy of the name of physician, aye, is there any intelligent person throughout the whole extent of this country, who does not know that the waste of human life, due to the insufficient obligations for the prevention of epidemic diseases, is many times greater than that from all other causes combined? And is there any one who, in the face of such knowledge, would not cheerfully acquiesce and heartily coöperate in the enactment of such laws and ordinances—national, state, and local—as shall have for their object

the saving of 100,000 lives and twenty times as many cases of illness annually in the United States?

If there are indeed any such persons, they are dangerous to the communities in which they live; more dangerous than the incendiary, the thief, or the highwayman, in the same proportion as the fatal epidemics with which they ally themselves are fraught with danger to the communities which tolerate them—more than all other enemies of mankind put together.

As physicians are usually the first to recognize the existence of an epidemic disease, laws for the compulsory notification of their existence to the sanitary authorities should be made specially applicable to them, but so worded as to make it a criminal offence for any one who knowingly secretes a case of epidemic disease under any pretence whatever; and the laws for compulsory vaccination, so conditioned in relation to the registration of births as to make it the duty of the sanitary authorities to see to it that every living child shall be vaccinated within six months of its birth.

The conditions under which epidemic diseases exist and may be assailed, may be summarized as follows:

1. Every epidemic disease is due to a specific germ or active principle which exclusively propagates its kind.

2. The specific germs or active principles of epidemic diseases are never in total abeyance: they always exist somewhere, and are active under conditions favorable to their propagation.

3. The germs or active principles which are the specific causes of epidemic diseases are capable of multiplication in the human body.

4. The excretions from persons affected with epidemic diseases, and the dead bodies of those who have died of them, contain the germs or active principles, and may be the means of disseminating them.

5. The excretions and dead bodies of persons infected with the germs or active principles of epidemic diseases may, by their manner of disposal, contaminate the air and the material substances of their surroundings, and the germs or active principles thus disseminated may lie dormant in the material surroundings of such excretions and dead bodies for unknown periods, just as the seeds of plants may lie without losing their vital properties until awakened into activity by congenial conditions.

6. Epidemic diseases are portable with the persons, dead bodies, and material substances to which the specific germs or active principles by which they are caused are nourished and propagated.

7. In the words of John Simon, "The prevalence of external conditions tending in certain localities to determine a specific decomposition of excrement, communicable to other organic substances, and infecting the air, is an essential element in an epidemic period."

8. And, finally, while the germs of all epidemic diseases have the common property of multiplication within the human body, some, at least, and most notably cholera and yellow fever, have their great centres of multiplication elsewhere, probably subject to some specially intensified

condition or conditions comprehended in the proposition just above quoted from John Simon.

The practical means for the management of epidemics, deducible from the foregoing propositions, are for the most part comprehended in the preceding special reports.

It may be stated in general terms, however, that they imply competent sanitary authorities in every place, and such needful appliances to carry them into effect as may be made acceptable to all communities. But it is the exigency of the hour that there still exist, in various high places, persons in authority who are ignorant of or purblind to all recent advances in the progress of practical sanitation.

That much dreaded epidemic, the cholera, now on its way to this country, finds great cause for encouragement in the circumstance that instead of the complete isolation and care of those affected with it, and the prompt disinfection of all things pertaining thereto, it is kept on public exhibition, and the material substances supposed to be infected are kept or placed under the most favorable conditions for propagating the poison. On information gleaned from the foreign sanitary press, the cholera hospitals of France and Italy are places of public resort, and promenading through them, by persons in no way connected with their management, of daily occurrence. First, the government officials go round, it may be to see whether orders are properly executed: this would be well under proper restrictions. But next follow, or perhaps pass simultaneously, various persons,—a prince, perhaps, the members of the extreme left, municipal officers of neighboring cities, a commission appointed by the *societé médical* on their own responsibility, journalists, consular reporters, newspaper correspondents, and curious persons,—who return to their respective homes or hotels, without change of clothing, to describe what they have seen. Among the acts most commonly observed is the throwing of a few cupfuls of copperas or chlorine solutions into the close-stools, or sprinkling some of the same or similar fluids on the floors. At the outskirts—the depots of arrival for travellers, with little or no regard from whence—all new-comers are obliged to pass through an almost suffocating vapor of some kind, under the pretence of killing the *bacilli Kochi* lurking in their apparel or attached to the person. At some of the seaports of Italy and Spain the ordinances of the famous Viscount Bernarbo appear to have been kept intact for the last five hundred years, and are practised now with the same diligence as they were in his day. All travellers, with their effects, are subjected to detention in uncleanly places, eminently promotive of the vitality of cholera or any other kind of disease germs. Meanwhile, at the ports of entry in those countries, as in the United States, by order of the secretary of the treasury (at the time of this writing), cargoes of rags are retained on board vessels under the most propitious conditions possible for rousing into activity latent germs of every kind, but which otherwise,—assuming their existence,—should, with the rags, be promptly disinfected with *steam*, now endorsed by the most distinguished sanitarians everywhere as the most, if it is not

indeed the only, reliable disinfectant for such purposes. All such obstructive methods as have here been referred to—and more of like nature might be added—would be ludicrous in the extreme if they were not dangerous—if they did not promote rather than prevent epidemic diseases.

The suggestions of this report are intended completely to controvert all such absurdities. Quarantines and cordons, in so far as they maintain mere detention without prompt and active measures for the care of the sick, the protection of the well, and the purification of infected material, deserve the reprobation of all practical sanitarians everywhere.

We would have it understood that all diseases known as contagious, infectious, and endemic, are *epidemic* diseases; that exposure of the sources of epidemic diseases and the active principles or germs by which they are propagated to the free atmosphere is among the most powerful and in some cases the only means necessary for controlling them; and that such exposure to the free atmosphere is, by means of tents, eminently practical and adaptable to all the required conditions; the complete separation and proper care of the sick from the well, of the family, the institution, the village, or the city; and for the prompt removal of *all* persons from infected houses, vessels, and places.

As for any measures with special reference to cholera, what has been said of the means necessary for the prevention and control of other epidemic diseases equally applies to it; and wherever these means are watchfully and energetically applied, we are confident of their efficacy against cholera as against other epidemics.

Respectfully submitted. A. N. BELL,
Chairman of Committee.

New York, Oct. 12, 1884.

REPORT OF COMMITTEE ON "CATTLE DISEASES."

Your committee beg leave to report that during the past year there have been no general or widespread epidemics among our domesticated animals. Pleuro-pneumonia has appeared in several localities, but has been promptly suppressed by the vigilance of sanitary authorities. It is now causing some apprehension by recent outbreaks in Ohio, Indiana, and Iowa. Your committee would call the attention of the association to its dangerous character and its present threatening attitude.

Swine plague, or hog cholera, has also appeared in some localities, particularly in Pennsylvania and Ohio. An epidemic, supposed to be hog cholera, is at present making fatal ravages in Nebraska. We recommend continued study and watchful care in this direction.

Your committee would call the attention of this association to the fact that our inland lakes and rivers are capable of furnishing a large and important supply of wholesome food. We find that these waters are not by any means producing their maximum supply, but, on the contrary,

are fast becoming depopulated of their finny inhabitants. We believe it is possible, by artificial means and scientific care, to repopulate these waters, and to protect and preserve this supply. We are encouraged in this belief by the very satisfactory results obtained in the state of Michigan. The report of the fish commissioner shows that the waters of that state yield annually 75,000,000 pounds of fish, and that this is far below the maximum capacity of those waters. He believes that by means of their artificial hatcheries, they shall not only continue and preserve the present supply, but that it may be indefinitely increased. We recommend that efforts be made to procure a paper for our next meeting on "The Best Methods of Increasing and Preserving this Source of Food-Supply."

Respectfully submitted. J. M. PARTRIDGE,
Chairman Com. on Cattle Diseases.

REPORT OF COMMITTEE ON COMPULSORY VACCINATION.

On behalf of and at the request of Dr. E. L. Griffin, of Wisconsin, chairman of the Committee on Compulsory Vaccination, who is unavoidably absent from this meeting, I beg to say, that in consequence of the very full and complete report made last year through its then chairman, Dr. Eugene Foster, of Georgia, the members after conference have deemed it unnecessary to submit anything further on the subject at the present meeting.

GEO. HOMAN, M. D.,
Acting Chairman.
S. W. ABBOTT.

REPORT OF THE COMMITTEE ON SCHOOL HYGIENE.

The special committee appointed to inquire into school hygiene beg leave to submit the following report:

The general subject of school hygiene embraces so many topics of interest, that the committee thought it advisable to divide the work, and present special papers on different branches of the subject.

Dr. E. M. Hartwell, of Johns Hopkins University, has prepared an elaborate paper on "Physical Training in American Colleges and Schools."

Dr. S. W. Abbott will furnish a paper on the "Water-Supply and Drainage of School-Houses."

Dr. E. S. Elder will furnish a paper on the "Sanitary Survey of the School-Houses of Indiana."

Other papers on the general subject of school hygiene are promised by Dr. Stephen O. Richey, of Washington, and Dr. Felix Formento, of New Orleans.

Our personal observation of the hygienic condition of schools has been confined to the institutions in and around Boston. In company with Dr. D. F. Lincoln, who is preparing a report on the sanitary condition of the schools in Massachusetts, we visited a number of the typical schools in Boston and vicinity. A report of the sanitary condition of the schools of Lynn, Mass., has just been completed, and by permission of Dr. J. G. Pinkham, the chairman of the committee, we have incorporated his table into our report.

We think the schools in Boston and vicinity fairly represent the schools of the country, and believe, therefore, that our observations on the condition of the schools in this vicinity will be applicable to a great many schools elsewhere. We are prepared to state that all of the schools we visited were defective in some particular,—one in location and drainage, another in ventilation and light, a third in seating arrangements, playgrounds, privies, etc. The relative proportion of these defects may be inferred upon reference to Dr. Pinkham's table. We suggest that before an extended report is made upon this subject by the American Public Health Association, some measure be taken for ascertaining the hygienic and sanitary conditions of the schools throughout the country. The best way of gaining the necessary information upon which to base an intelligent and comprehensive report is to circulate blank forms, upon which questions are printed soliciting the desired facts. This information might be obtained through the state boards of health, some of them having already begun to investigate this subject.

As a rule, we have found the teachers ready to aid in any measure to improve the sanitary and hygienic condition of the schools, and we feel confident that if these circulars were sent to the school-teachers throughout the country, a volume of information would soon be obtained that would furnish a basis for a practical method of correcting some of the existing evils. We recommend to the association the adoption of some such form as the one given below, subject to the approval of the Committee on School Hygiene.

D. A. SARGENT, *Chairman*,
E. S. ELDER,
S. W. ABBOTT.

Questions relating to the Sanitary Condition of School-Buildings visited by the Department of Health, Massachusetts State Board of Health, Lunacy, and Charity.

A.—INTRODUCTORY.

1. Name of school,
2. Name of town, 3. Date,
4. Street, 5. Principal,
6. Grade, 7. Date of erection and remodelling,
8. To what other uses is the building applied?
9. How many rooms for school purposes? 10. How many teachers?
11. Average attendance of boys, 12. Of girls,

B.—SITE.

1. Size of play-ground (out of doors), 2. How paved? 3. Grass, trees, flowers, etc.?
4. How much slope has the general surface?
5. Any special exposure to sun or weather?
6. What water near by, near school level?
7. Any standing water in lot? 8. Paths muddy?
9. Nuisances in neighborhood from noise, dust, smell, etc.?

C.—PLAN.

It will add much to the value of this report if the teacher will make a simple plan of one or more stories of the building, as can be done in five or ten minutes; and also an outline of the house-lot, to show the situation of the house, well, privy, cesspool, and objectionable neighbors.

D.—SOME POINTS OF CONSTRUCTION.

1. Material? 2. Number of stories? 3. Special use to which any one story is put?
4. In what way out of repair?
5. How far fire-proof?
6. Can any room be cut off from stairs by a fire of limited extent?
7. Are there fire-escapes?
8. Do doors open outwards?
9. Width of staircase, 10. Of tread, 11. Height of riser.
12. Are there any curved or angular steps?
13. In what way (if any) is the plan of the building unusual; or defective; or excellent?

E.—VENTILATION.

1 Please fill up the following table. If several rooms are alike, class them together. If the school is so graded that the size of classes is uniform within one or two, assume a uniform average, to save trouble.

Number of Rooms.	Length and Breadth.	Height.	Cubic capacity.	Average attendance during the most crowded period.	Cubic space per scholar.

2. State what overcrowding beyond the prescribed standard occurs.
3. Are windows systematically opened? Describe your practice.
4. Are boards fitted to all the windows to deflect currents of air from the scholars?
5. Are there transoms over doors? 6. Are they kept open?
7. Are there double windows?
8. Are there holes in the walls of rooms to let air directly in? 9. How many (in each room)? 10. Size, 11. Height.
12. How many ventilating flues (in each room)? 13. Of what made?
14. Their internal dimensions (not size of register).
15. Are they heated, and how? 16. Where do they discharge, and how is the outflow aided or protected at this point?
17. Where is the orifice in the room?
18. Is the draught strong? 19. Is it regular?
20. How many open fire-places?

TABLE—PART I. By DR. J. G. PINKHAM. [From Report on the "SANITARY CONDITION OF THE SCHOOL-HOUSES" of Lynn, Mass.]

LOCATION.	SOIL.	SURFACE DRAINAGE.	UNDER-DRAINAGE.	SURROUNDINGS.	PLAY-GROUND.	MATERIAL.	DATE OF ERECTION.	NO. OF ROOMS.	No. of seats.	STAIRS.	HALLS.	Cubic air-space per scholar	MEANS OF VENTILATION.	DIRECTION OF LIGHT.	Ratio of window to floor space.	Means of controlling light.	WALLS.	MEANS OF HEATING.	WATER-CLOSETS.	PRIVIES.	URINALS.	SINKS AND WASHBOWLS	WASTE-PIPES.	DRAIN.	CESSPOOL.	CELLAR.
Lynnfield St.	Coarse gravel	Defective	Good	Fair	Ample, needs grading	Wood		1	68	None	Two large entries	157 ft.	Window boards	From rear and both sides	8 p. c.	Outside blinds and curtains	White	Stove	None	Accommodations too limited. In fair condition	None	Clean	Trapped	Probably trapped	10 ft from building. Not ventilated	None
Chatham St.	Damp—clay subsoil	Defective	Bad	Good	Of good size	Wood		1	64	None	Two small entries	167 ft.	Flue in chimney and window boards	From both sides	8 p. c.	Outside blinds and curtains	White	Stove	None	Rather limited. Wooden vaults. Generally well kept	None	Clean	Not trapped	Trapped	12 ft from building. Shallow	None. Wooden basement
Fayette St.	Coarse gravel	Defective	Good	Bad	Large enough but rough—needs grading	Wood	1864	2	134	One narrow flight	Small	114 to 150 ft.	Flue in chimney and patent window ventilators	From both sides	12 p. c.	Outside blinds and curtains	Papered—light below, white above	Stoves	None	Very limited. In fair condition	None	Clean	Trapped	Not known if trapped	In yard. Not ventilated	Dry and nice; half cellar
Jackson St.	Gravelly	Good	Good	Good	Rather too small	Wood		2	120	One narrow flight	Small	135 ft.	Wooden duct and window boards	From both sides	14 p. c.	Outside blinds and curtains	White	Stoves	None	Vaults badly constructed and offensive	None	In fair condition	Trapped	Not known if trapped	In yard. 12 feet from building	In good condition
Parrott St.	Gravelly	Good	Good	Good	Of good size. In good condition	Brick	1859	4	252	Four flights	Ample	180 ft.	None that can be used	From one side only	8 p. c.	Curtains—one room inside blinds	White	Stoves	None	Ample and in good condition	Nearly new—in good condition	None. No water in building	None	None	None	Good
Red Rock St.	Coarse gravel	Good	Good	Good	Too small—rough—not well cared for	Brick	1866	2	132	Two flights—fair	Ample	200 ft.	Flue in chimney—top and bottom register	From both sides	10 p. c.	Inside blinds	White	Stoves	None	Foul. Poor construction	Small and dirty	Clean	Not trapped	Trapped	25 feet from building. Ventilated	Under ¼ building; dry and clean
Baltimore St.	Loam and sand	Good	Good	Good	Ample and in good condition	Wood	1851	2	132	Two flights—very steep and hard	Small	162 ft.	Wooden ducts and window boards	From both sides	11 p. c.	Outside blinds and curtains	Papered—neutral tint	Stoves	None	In fair condition	Outside privy New	Clean	Trapped	Not known if trapped	In yard. Not ventilated	In good condition
School St.	Sand and gravel	Mostly good	Good	Good—with some decided exceptions	Too small	Wood	1853	5	307	Two flights—fair	Ample	234 ft.	Various devices—insufficient	Two rooms from front and one side; remainder, one side only	10 p. c.	Curtains	White	Stoves	None	Recently repaired. In fair condition	New	Complaint by teachers of bad odor	Not trapped	Probably not trapped	Hogshead in cellar	Dry. Dirty
High St.	Coarse gravel—rocky	Good	Good	Objectionable	Badly situated and too small	Wood		2	126	One flight—narrow and steep	Small	138 ft.	Flue in chimney and window boards	From rear and both sides	14 p. c.	Outside blinds and curtains	White	Stoves	None	Recently repaired. In fair condition	Badly situated and offensive	None	None	None	None	Small. Used for wood—dry
Beach St.	Gravelly	Defective	Good	Very objectionable	Badly situated and too small	Wood		2	125	One flight—fair	Small	162 ft.	Flue in chimney and window boards	From both sides	11 p. c.	Outside blinds and curtains	One papered—neutral tint—one white	Stoves	None	Too limited. Foul	None	Clean	Not known if trapped	Not known if trapped	Probably one in the yard	Half cellar. In fair condition
Franklin St.	Gravelly	Good	Good	Good	Ample and in good condition	Wood		2	120	One flight—narrow and steep	Small	132 ft.	Wooden duct and window boards	From both sides	16 p. c.	Outside blinds and curtains	White	Stoves	None	Of good construction, but not well cared for	None	Clean	Not trapped	Trapped	12 ft from building. Not ventilated	Shallow and dry
Franklin St. (Cobbet Yard)	Gravelly	Good	Good	Good	Ample and in good condition	Brick		4	232	Two flights—ample	Ample Warmed	220 ft.	Flues in rear and front, and window boards	From rear and both sides	21 p. c.	Inside blinds	White	Steam—direct radiation	Pan—in basement not first-class	In fair condition. Well cared for by janitor	Badly situated. Floor needs to be concreted	None	Trapped	Enters sewer. Trapped	None	Basement has brick floor. In good condition
Blossom St.	Gravelly surface—clay subsoil	Defective	Doubtful	Fair	Small for the building	Wood	Remodelled in 1872	4	256	None	Central Large	215 ft.	Wooden ducts, chimney flue, and window boards	From rear and one side	20 p. c.	Inside blinds	White	Stoves	None	Ample and in fair condition	None	Clean	Trapped	Not known if trapped	Leads into open stone drain	Naturally damp
Laighton St.	Coarse gravel	Defective	Good	Fair	Ample, needs grading	Wood	1868 Old engine-house	1	64	None used	Ample	223 ft.	Window boards	From both sides	16 p. c.	Curtains	White	Stove	None	Plank vaults. Badly situated and not well cared for	None	Clean	Discharge on ground. Not trapped	None	None	None
George St.	Sandy	Defective	Good	Good	Rather small, needs grading	Wood		2	116	One narrow flight	Small	165 ft.	Wooden duct and window boards	From both sides	14 p. c.	Outside blinds and curtains	White	Stoves	None	Accommodations insufficient. Pretty well cared for	None	Clean	Not known if trapped	Not known if trapped	Nothing known about it	None
Cottage St.	Somewhat gravelly—clay subsoil	Defective	Good	Somewhat objectionable	Of good size, needs grading	Wood		2	125	One flight—fair	Of good size	222 ft.	Flue in chimney and window boards	From both sides	10 p. c.	Outside blinds and curtains	White	Stoves	None	Limited and of poor construction. Well cared for	None	Clean	Trapped	Trapped	Old hogshead 8 ft from building. Not ventilated	None
Elm St.	Surface sandy—clay subsoil	Good	Probably defective	Good	Small, but in good condition	Wood		2	126	One flight—rather narrow	Of fair size	130 ft.	Flue in chimney and window boards	From rear and both sides	17 p. c.	Inside blinds	White	Stoves—lower room hard to heat—unplas'ed	None	Sufficient. Too much exposed. Well cared for	None	Clean	Trapped	Not known if trapped	Probably one in yard	Sometimes damp
Chase Ave.	Sandy	Good	Good	Good	Ample and in good condition	Wood	1878	2	112	Winding and steep	Of good size	202 ft.	Duct in dead wall—inoperative	From both sides	16 p. c.	Curtains	White	Stoves	None	Sufficient and well cared for	Wooden troughs	Clean	Trapped	Not known if trapped	In yard. Not ventilated	Dry and airy
Centre St.	Gravelly	Defective	Probably good	Good	Of good size, needs grading	Wood	1853	3	185	Two flights—fair	Ample	244 ft.	Various devices—none effective	Mostly from one side	16 p. c.	Inside blinds	White	Stoves	None	In poor condition, and not kept clean	None	Clean	Not known if trapped	Ends under building	None	None
Grove St.	Gravelly	Good	Doubtful	Good	Rather small. In good condition	Wood		2	120	One narrow flight	Of fair size	136 ft.	Flue in chimney and window boards	From both sides	15 p. c.	Outside blinds and curtains	White	Stoves—bad draught in up. room—gas, etc.	None	New plank vaults. Seats not kept clean	None	Clean	Not trapped	Ends under building	None	None
Myrtle St.	Gravelly	Good	Good	Stable, piggery, and cow-barn near	Ample. In poor condition	Wood	Remodelled in 1870	1	56	None	Ample	132 ft.	Useless wooden duct and window boards	From both sides	16 p. c.	Outside blinds and curtains	White	Stove	None	Of faulty construction, too limited, and not well kept	None	Clean	Not trapped	Ends under building	None	None
Boston St.	Gravelly	Good	Good	Good	Ample. In good condition	Wood		1	56	None	Ample	161 ft.	Flue in chimney	From both sides	15 p. c.	Outside blinds and curtains	Papered—neutral tint	Stove—bad draught	None	Ample and in good condition.	None	Clean	Not trapped	Probably ends under bld'g	None	None

TABLE—PART II. By DR. J. G. PINKHAM. [From Report on the "SANITARY CONDITION OF THE SCHOOL-HOUSES" of Lynn, Mass.]

NAME.	LOCATION.	SOIL.	SURFACE DRAINAGE.	UNDER-DRAINAGE.	SURROUNDINGS.	PLAY-GROUND.	MATERIAL.	DATE OF ERECTION.	NO. OF ROOMS.	NO. OF SEATS.	STAIRS.	HALLS.	CUBIC AIR SPACE PER SCHOLAR.	MEANS OF VENTILATION.	DIRECTION OF LIGHT.	RATIO OF WINDOW TO FLOOR SPACE.	MEANS OF CONTROLLING LIGHT.	WALLS.	MEANS OF HEATING.	WATER-CLOSETS.	PRIVIES.	URINALS.	SINKS AND WASHBOWLS.	WASTE-PIPES.	DRAIN.	CESSPOOL.	CELLAR.
High	High and Liberty Sts.	Rocky and dry	Good	Good	Excellent except in rear of yard	Small and uneven	Wood	1850 Enlarged 1876	8	280	Winding. Rather steep	Ample on lower floor. Too small above	241 to 321 ft.	Wooden shafts connecting with three Emerson ventilating towers on roof. Top and bottom register in each room	From rear and one side	12 to 15 p. c.	Inside blinds	Tinted neutral	Five furnaces. Air taken from out of doors	Badly situated and of faulty construction. Pan. Bad odor	Accommodations insufficient. One vault filthy	New and in good condition	Appear clean	Some not trapped	Said to be trapped and ventilated	Near wall of building	Dry. Floor uneven and rocky.
Ingalls	Essex St.	Gravelly and dry	Good	Good	A foul pool called "Silver Lake" in rear of yard, at a short distance. Otherwise good	Rather limited for number of scholars, but in good condition	Brick	1872	14	730	Broad and of easy grade. Two flights opening into central hall	Ample and well warmed	187 to 257 ft.	Wooden shafts connecting with central tower on roof. Not heated. Top and bottom registers in each room	Ten rooms from rear and one side. Four rear and both sides	10 to 13 p. c.	Inside blinds. Curtains in one room	Nearly all white	Steam. Direct and indirect radiation	Pan. In basement Fair condition. No ventilation.	Vault filthy. Not cleaned out for two years. Bad arrangement	One outside. Not sufficient. Can be flushed. Drains on ground	Appear clean Bad odor from sink in hall	Not separately trapped	Not known if trapped—probably not. Ventilated into chimney in basement	Near east side of yard. Not ventilated. Connects with vault. No connection with sewer	Brick floor. Dry, except near one water-closet, where there appears to be a leak.
Whiting	Ireson St.	Made ground. Surface dry	Good	Doubtful	14 privies near the yard fence. Neighborhood good in other respects	Too small but in good condition	Brick	1869	10	570	Rather narrow and of not very easy grade	Too small. Central Warmed	213 to 240 ft.	Wooden shafts connecting with ventilators on roof. Registers at top of room. Two in each. Many of the valves are out of order and cannot be opened	From rear and one side	11 p. c.	Inside blinds. Curtains in one room	White	Steam. Direct radiation	Old style. Soil-pipe extends through the roof	Of poor construction. 36 ft. from building. Tolerably well cared for	Recently repaired. Can be flushed	Clean	Not separately trapped	Trapped. Leads to sewer in Ireson street	Not ventilated. Rain-water from roof goes to vault, thence to cesspool, overflow to sewer	Damp from defective under-drainage, or other cause.
Sanborn	Maple St.	Portion of ground made by filling in creek. Surface gravelly and dry	Good	Probably good	At rear and on east side is unfilled portion of old creek which at times contains foul, stagnant water	Of fair size and in good condition	Brick	1880	8	486	Broad and of easy grade. Two flights opening into central hall	Ample and well warmed	190 to 257 ft.	Ventilating flues: one in wall, one in chimney in each room. Two end in attic, two on roof. Means of ventilation wholly inadequate	From rear and one side	16 p. c.	Green curtains, rolling up at top of windows	White	Steam. Direct and indirect radiation	Of modern style and in good condition. Ventilated	Eleven seats in all. Not enough. Brick vault. No means of flushing or cleaning out	Zinc-lined trough. Can be flushed with hose	In excellent condition	Trapped	Trapped and ventilated	In yard near rear. Ventilated by pipe running above building	Concrete bottom. Dry. Ventilated in same manner as rooms above.
Shepard	Warren St.	Gravelly and dry	Good	Good	Good	Of fair size and in good condition	Brick	1869	10	567	Similar to those of Whiting School	Similar to those of Whiting school	206 to 230 ft.	Wooden shafts connecting with galvanized iron ventilators on roof. Opening at top of room	Rear and one side	11 p. c.	Inside blinds	White	Steam. Direct radiation	Of old pattern. Not properly constructed or ventilated. Clean	Not very clean. Construction poor	New	In good condition	Not properly trapped	Not known if trapped	In yard, about 15 ft. from building	Cemented bottom, dry, and in good condition.
Cobbet	Franklin St.	Clay subsoil. Gravel filling. Surface dry	Good	Good	Good	Of good size and in good condition	Brick	1872	14	758	Similar to those of Ingalls School	Similar to those of Ingalls school	168 to 260 ft.	Wooden shafts connecting with central tower on roof. Registers near floor	Ten rooms rear and one side Four rooms rear and both sides	10 to 13 p. c.	Inside blinds	Tinted	Steam. Direct and indirect radiation	Pan. In basement Not ventilated. Clean	Brick vault. Stone floor. Ample and well cared for. Best in city. Flushed into catch-basins	In good order, but badly placed	In good condition	Not all trapped	Main drain trapped. Connects with sewer. Drain from catch-basin in girls' yard not trapped. Overflow of vaults to sewer	In yard. Overflow to sewer. Receives surface and roof water	In excellent condition.
Burrill	Boston St. Tower Hill	Rocky and rough	Good	Good	Good	Large and rough. Needs grading	Wood	Enlarged 1882	4	232	Three flights. Ample	Of fair size	177 ft.	Various devices, not satisfactory	From both sides	15 p. c.	Outside blinds and curtains	White. One upper room papered	Stoves	None	First-class, and well cared for. Brick vault	Zinc-lined. No flushing	Clean	Trapped	Trapped	Old well in yard, about 25 ft. from building	Under one half building. Dry.
Ward 1 Grammar School	Boston St.	Coarse gravel	Good	Good	Good	Of fair size and in good condition	Wood	1870	2	93	One flight of fair width and easy grade	Small entry	248 ft.	Flue in chimney next to smoke flue. Top register in each room	From rear and both sides	16 p. c.	Outside blinds, and curtains rolling up to top of window	Tinted light blue	Two stoves in each room	None	Nearly new. In good condition	Wooden trough back of privy	In good condition	Not separately trapped	Trapped	In yard, 7 ft. from building. Ventilated by roof conductors	Dry, and in good condition.

21. If you compare the value of the flues, open fire-places, openings through walls, transoms, window-boards, and simple opening of windows, upon which do you mainly depend for such ventilation as you have?
22. What is the general result?

F.—HEATING.

1. How many stoves? 2. Where?
3. Have they screens? 4. Are they of special construction in any way?
5. How many furnaces? 6. Have you indirect steam-heating?
7. Where are the coils placed?
8. What is the size of the fresh-air inlets for furnaces or steam-coils?
9. Are the inlets near privies, stables, or any place where the air is of doubtful purity?
10. Is any air taken from in-doors during school hours to supply furnaces or heating coils?
11. Are there coils in the rooms? Or corridors?
12. Are they associated with inlets for fresh air? If so, describe the latter.
13. Are they screened? 14. Is the house sufficiently warmed?
15. Do you keep thermometers in all the rooms? 16. What temperature is preferred?

G.—DRAINAGE, ETC.

1. Does the cellar extend under the whole house? 2. Height?
3. Well lighted? 4. Well aired?
5. What kind of floor? 6. Is it kept neat?
7. Is it ever damp? 8. Is it used as a play-ground?
9. Is the house damp? 10. If no cellar, describe sub-floor space.
11. Describe construction of the water-closets, earth-closets, or privies; of the urinals and vaults; tell how many (for teachers and for scholars), and where situated.
12. Is the position objectionable? 13. Are they well lighted?
14. Warmed? 15. Ventilated? 16. Describe ventilation.
17. State of repair?
18. Neatness?
19. What is done to keep them clean, disinfect, flush, etc.?
20. Are they offensive?
21. What regulations for the use of them?
22. How are the girls separated from boys?
23. Is the drinking-water good? 24. If from well or cistern, how are you sure that it is unpolluted by vaults, etc.?
25. Describe places for washing and drinking.
26. Are waste-pipes trapped? 27. Drains trapped?
28. Where do they discharge?
29. Are cesspools ventilated?
30. What kind of soil are they in?

H.—LIGHTING AND FURNISHING.

1. Of what pattern are the desks and seats?
2. How many sizes in a room?
3. To what range of ages does that correspond?
4. Height of seat? 5. Of near edge of desk?
6. If a plumb line is dropped from edge, where does it fall relatively to the seat?
7. Are any children in need of foot-rests? 8. What kind of blackboards?
9. Are any placed on a side on which there are windows?
10. What kind and color of blinds and shades?
11. Do they darken too much?
22. Do the blinds obstruct air in summer? 13. Color of walls? 14. Of ceiling?
15. Is light deficient, to what extent, and in how many rooms?
16. What neighboring objects cut it off?
17. In how many rooms do scholars sit facing windows?
18. Ratio of window-surface to floor-surface in each room (expressed decimally)?
19. Is the printed text of any books, or maps, bad for the eyes?

20. Complaints of trouble of the eyes, by teachers or scholars?
21. Are there separate rooms for clothes? 22. Are they airy and light?
23. Does each child have a hook? 24. Do clothes hang one piece over another?
25. If not in separate rooms, where are clothes hung?
26. Are there mats and scrapers? 27. What is done in case of wet feet?

K.—HEALTH.

1. What record of vaccinations do you keep?
2. How many scholars at present not vaccinated? 3. Number of cases of scarlet fever within school year ending last July? 4. Of measles?
5. Of diphtheria? 6. Of whooping-cough?
7. Percentage average of absences for illness during the year (if you can make an estimate)? 8. Has the school been closed on account of any epidemic, and what? 9. Underline any of the following that you think more prevalent than they should be: Headaches, weakness or delicacy, nervousness, progressive loss of strength, colds, deafness, defective sight, deformity of spine or shoulders, amenorrhœa.
10. Draw a *second line* under any in which you think school work or influences have acted as a cause.
11. Note cases of any other disorder that you think may possibly be connected with school influences.
12. In what months are absences most frequent? 13. Causes?
14. Are there any printed or recorded rules of the school board relating to the care of the scholars' health, or to the prevention of contagious diseases? Please send copy.
15. What are your own rules of practice?
16. What are the school hours, and hours of recess?
17. What distinction is made in case of young scholars?
18. How are scholars and teachers occupied during recess?
19. How many hours of study and recitation (at school and at home) do you expect of scholars per week at the ages of 5? 6? 8? 12? 16?

REPORT OF THE SUB-COMMITTEE ON INCORPORATION.

The Sub-Committee on Incorporation has made due inquiry in relation to the subject submitted for its consideration.

The association may be incorporated under the provisions of the act of congress, approved April 23, 1884, entitled "An act to amend the Revised Statutes of the United States relating to the District of Columbia, and for other purposes."

To fulfil the requirements of this act, certain members of the association, duly authorized to represent it in this matter, will have to make, sign, and acknowledge, before an officer authorized to take acknowledgments of deeds in the district, and file in the office of the recorder of deeds, to be recorded by him, a certificate in writing, in the following or similar terms:

We, the undersigned, members of the American Public Health Association, do certify, that at the twelfth annual meeting of the association, held at St. Louis, Missouri, on the 14th–17th of October, 1884, a resolution was adopted, and recorded in the minutes of the meeting, authorizing us to draw up, sign, and file this certificate on behalf of the associa-

tion, in accordance with the requirements of the act approved April 23, 1884, entitled "An act to amend the Revised Statutes of the United States relating to the District of Columbia, and for other purposes."

That, in accordance with said resolution, the association which we represent shall be known in law as the American Public Health Association.

That the said American Public Health Association is hereby organized for the term of one thousand years from the date of this certificate.

That the objects of the American Public Health Association are the advancement of sanitary science, and the promotion of organizations and measures for the practical application of public hygiene.

That the officers of the American Public Health Association consist of a president, first and second vice-presidents, a secretary, and a treasurer; but that all disbursements and expenditures are made under the direction of the Executive Committee, which consists of the officers aforesaid, and six members annually elected by ballot.

Signed A, B, &c.

In the presence of any officer authorized to take acknowledgment of deeds in the district.

The incorporation cannot be effected by the officers or the Executive Committee, as section 545 of the Revised Statutes of the United States, relating to the District of Columbia, requires that a majority of the incorporators shall be citizens of the district. The drawing up and filing of the articles of incorporation must therefore be delegated to a special committee, which might with propriety consist of the president, secretary, and treasurer, and as many members of the association who are citizens of the district as are required to constitute them a majority of the committee.

Therefore, if it be considered desirable to effect this incorporation, it is recommended that a resolution be passed authorizing the appointment of a committee, constituted as stated, for the purpose of drawing up, signing, and filing the articles of incorporation on behalf of the association.

The expenses attending the signing and recording of the deed are trifling, amounting only to a few dollars.

Appended is a copy of the act of April 23, 1884, referred to in the body of this report.

ALBERT L. GIHON.
JAMES E. REEVES.
CHARLES SMART.

[PUBLIC—NO. 24.]

AN ACT to amend the Revised Statutes of the United States relating to the District of Columbia, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sections of the Revised Statutes of the United States of America, relating to the District of Columbia, be and they are hereby amended in the following manner; that is to say,—

Section five hundred and forty-five, by striking out the words "not exceeding twenty years;" so that the same shall read,—

"SEC. 545. Any three or more persons of full age, citizens of the United States, a majority of whom shall be citizens of the district, who desire to associate themselves for benevolent, charitable, educational, literary, musical, scientific, religious, or missionary purposes, including societies formed for mutual improvement, or for the promotion of the arts, may make, sign, and acknowledge, before any officer authorized to take acknowledgment of deeds in the district, and file in the office of the recorder of deeds, to be recorded by him, a certificate in writing, in which shall be stated,—

"First. The name or title by which such society shall be known in law.

"Second. The term for which it is organized.

"Third. The particular business and objects of the society.

"Fourth. The number of its trustees, directors, or managers for the first year of its existence."

Section five hundred and forty-six, by adding at the end thereof the words "and other real and personal property, the clear annual income from which shall not exceed in value twenty-five thousand dollars;" so that the same shall read,—

"SEC. 546. Upon filing their certificate, the persons who shall have signed and acknowledged the same, and their associates and successors, shall be a body politic and corporate, by the name stated in such certificate; and by that name they and their successors may have and use a common seal, and may alter and change the same at pleasure, and may make by-laws and elect officers and agents, and may take, receive, hold, and convey real and personal estate necessary for the purposes of the society, as stated in their certificate, and other real and personal property, the clear annual income from which shall not exceed in value twenty-five thousand dollars: *Provided*, *however*, That this section shall not be construed to exempt any property from taxation in addition to that now specifically exempted by law."

Section five hundred and forty-seven, by striking out the words "annually, or oftener, elect from its members," and inserting the word "elect" after the word "may" in the first line; so that the same shall read,—

"SEC. 547. Such incorporated society may elect its trustees, directors, or managers at such time and place and in such manner as may be specified in its by-laws, who shall have the control and management of the affairs and funds of the society, and a majority of whom shall be a quorum for the transaction of business; and whenever any vacancy shall happen in such board of trustees, directors, or managers, the vacancy shall be filled in such manner as shall be provided by the by-laws of the society."

That section five hundred and forty-nine of the Revised Statutes relating to the District of Columbia be and the same is hereby repealed; and in lieu of said section the following is enacted:

"SEC. 549. Any property of the corporation may be leased, encumbered by mortgage or deed of trust in the nature of a mortgage, or sold and conveyed absolutely, when authorized by a vote of a majority of the shares of stock of the corporation, or by a vote of a majority of the directors, managers, or trustees of the corporation, at a meeting called for the purpose, and the proceedings of which meeting shall be duly entered in the records of the corporation; and the proceeds arising therefrom shall be applied or invested for the use and benefit of such corporation."

SEC. 2. That section five hundred and fifty-one of the Revised Statutes, relating to the District of Columbia, be and the same is hereby repealed.

SEC. 3. That any corporation heretofore formed under sections five hundred and forty-five to five hundred and fifty-two inclusive of the Revised Statutes of the United States relating to the District of Columbia, may avail itself of the provisions of this act by complying with its requirements, and those that this act is intended to amend; but the right to repeal this act, and to alter, amend, or abolish any charter of incorporation granted under it, is expressly reserved to congress.

Approved April 23, 1884.

IN MEMORY OF DR. ELISHA HARRIS.

WHEREAS, The American Public Health Association since its last meeting has suffered an irreparable loss in the death of Dr. ELISHA HARRIS, one of its founders, and one of the foremost administrative and practical sanitarians in this country,—be it

Resolved, That a page in the book of the minutes of this association and of the current volume of its transactions be devoted to his memory, and to the following brief record of his connection with the association and with sanitary interests generally.

ELISHA HARRIS, one of the originators, the first secretary and the fifth president, of the American Public Health Association, died in the city of Albany, N. Y., on the 31st day of January, 1884, in the sixtieth year of his age.

His active connection with the sanitary work of New York city and state began in 1855, when he became superintendent and physician-in-chief of the quarantine hospital on Staten Island, during which incumbency he constructed a floating hospital for the lower quarantine station. Dr. Harris was a member of the Committee on Quarantine Regulations of the National Quarantine and Sanitary Convention, whose report before the convention in Boston, in 1860, comprehends all the essential details of the present quarantine establishment of New York.

Interrupted in this and in kindred work by the civil war, his energies and abilities were diverted for the time being to a new field,—that of army sanitation. To him is largely due the credit of the organization of the United States Sanitary Commission and the beneficent work accomplished through its agency.

As a member of the Council of Hygiene and Public Health of the Citizens' Association of New York, he organized and pushed to completion a systematic sanitary inspection of that great city, one of the immediate results of which was the formation of the present metro-

politan board of health. Under this board he was made sanitary superintendent of the city from 1868 to 1870, and while filling this office made a systematic inspection of the tenement houses, and so vigorously enforced the law providing for their ventilation and lighting that he secured, among other reforms, the putting in of nearly 40,000 windows and about 2,000 roof ventilators in the existing tenements in the year 1869. He also organized the first free public vaccination service and the system of house-to-house visitation.

In 1873 Dr. Harris was made Registrar of Vital Statistics for the city of New York, and in this office he carried out the same systematic, comprehensive, and intelligent plans which characterized every work which he undertook.

In 1880 he was appointed one of the commissioners of the newly created state board of health of New York, and upon its organization he was elected secretary, which office he continued to fill until his death.

To the results of his connection with other public work looking to the moral and physical improvement or amelioration of the lot of humanity, the records of the Prison Reform Association, of the Agency for Discharged Convicts, of the Association for Improving the Condition of the Poor, and many other organizations in this country and abroad, bear eloquent tribute.

No words of ours are needed to add to his fame. His works are in themselves a monument more enduring than brass. The sorrow which we cannot but feel at his loss is tempered with a just pride in the remembrance that he was one of our associates, and that in some things we had the high privilege of laboring with him.

REPORT OF THE COMMITTEE ON NECROLOGY.[1]

To the President and Members of the Association:

Your committee beg leave to submit the following report upon our deceased associates.

Brevet Brig. Gen. John M. Cuyler, M. D., was one of the oldest members, and, although retired from active service in the army, continued to take an active interest in matters appertaining to sanitation until the very last. He joined the association in 1873.

The following announcement of his death, by Surgeon-General Murray, to the medical department of the army, is but a just tribute to his worth and an appreciation of his noble character, by those who knew him best. We append it in full, that the association may have a record of one of its earliest members.

WAR DEPARTMENT,
Surgeon-General's Office,
Washington, D. C., May 1, 1884.

With profound sorrow, the death of Colonel and Bvt. Brig. General John M. Cuyler, U. S. A., retired, which occurred at his home in Morristown, N. J., April 26, 1884, is announced to the medical department of the army.

Dr. Cuyler was so well known personally and by reputation to the whole corps, that the mere mention of his death will at once recall his noble qualities as a man and officer. His strict integrity, his pure chivalric character, his highly developed intellectual and moral nature, his manliness and stern sense of duty, coupled with courtesy, kindness of heart, and consideration for others, which endeared him to those with whom he came in contact, are familiar to all.

He entered the army as an assistant surgeon in 1834, being among the first to pass the rigid examination instituted in 1833, which did so much to elevate the standard of the medical department, and which high standard he was so instrumental in upholding in after years; both in his professional career as a medical officer, and as a frequent member of examining boards from 1842 to 1862.

During an active service of nearly fifty years, he had the good fortune to participate in all the wars in which the country was engaged. He was actively on duty in the Creek and Seminole wars in 1838 and 1840. He served with great distinction through the Mexican war, and was highly complimented in orders by General Twiggs, and other commanding officers.

He received his promotion as major and surgeon in February, 1847, and in 1848 was ordered to West Point, where he served most acceptably for seven years.

Although of Southern birth, connected by the strongest bonds of kindred and friendship with many of the most distinguished men of that section, no ties of blood, no state

[1] Report made by Dr. G. P. Conn, of Concord, N. H., for the committee.

pride, could swerve him from his duty to his country and to the Union. He entered at once with characteristic zeal into the war of the Rebellion, and gave to the government the full benefit of his high attainments and long experience.

As the senior medical officer at Fort Monroe, during the first years of the civil war, his services were invaluable in organizing the medical department of the armies congregated there. Afterwards, as Medical Inspector and Acting Medical Inspector-General, his services were unremitting, responsible, and valuable. Since the war he held continuously the position of medical director of important departments until his retirement under provision of law, June 30, 1882.

Irreproachable in every relation of life, endowed with all the attributes of the finished gentleman and officer, a diligent student, a steadfast friend, loyal to his country in the time of need, and untiring in his devotion to duty, Dr. Cuyler leaves behind him a record of which every medical officer may justly be proud, and an example worthy the acceptance of all.

R. MURRAY,
Surgeon-General U. S. Army.

John Taylor Gilman, son of Col. Nathaniel and Dorothy (Folsom) Gilman, physician and surgeon of Portland, was born in Exeter, N. H., May 9, 1806, was fitted for college at Phillips Exeter Academy, admitted to Bowdoin college 1822, entered upon his baccalaureate in 1826, studied medicine in the office of William Perry, M. D., Exeter, N. H., and received his medical diploma at Bowdoin in 1829. For anatomical and clinical instruction, passed portions of the years 1830–'31 in Philadelphia. Commenced the practice of medicine and surgery in Portland, Me., Jan. 1, 1832. He was president of Maine Medical Association during 1864, overseer and for some time a trustee of Bowdoin college. He was also trustee of Maine Insane Hospital, and president of the board of directors of Maine General Hospital. Of the latter he was one of the founders, and during his connection with it he gave much time and money for its support.

Dr. Gilman was characterized in the medical profession for his quickness of perception and power of ready diagnosis, for his skilful and successful treatment of disease, for his active and prompt attention where duty required, and for his ever gentlemanly bearing towards all. His integrity in his professional duties, and his acknowledged ability as a physician and surgeon, won the confidence of all who knew him. It is a fact worthy of notice in the professional career of Dr. Gilman that he was the first physician in the state of Maine who performed the unusual operation of cæsarian section, which he did skilfully and successfully. Dr. Gilman married, August 24, 1837, Helen A., daughter of Hon. Reuel Williams, a United States senator, of Augusta, Me. We cannot better close this note than by an extract from the resolutions adopted by the profession after his death:

"Dr. Gilman was also born for the medical profession. He was possessed of innate refinement of nature, of a peculiar gentleness of manner, and at the same time of great decision of character. He early secured a very large and lucrative practice, and became one of the most distinguished of the physicians and surgeons of the state. He had the full confidence and affection of his patients."

Samuel D. Gross, of Philadelphia, was born near Easton, Penn., July 8, 1805, and died May 6, 1884. He became a member of this association in 1874. As a surgeon and an author his name was familiar to the profession, not only in America but throughout the whole civilized world. He graduated from the Jefferson Medical College in 1828, and began his practice in Philadelphia, employing his leisure hours in translating several French and German medical works, which were published; and in 1830 he issued his first original work, entitled "Diseases and Injuries of the Bones and Joints," in which particular mention is made of the use of adhesive plaster as a means of extension in the treatment of fractures. In 1833 he became demonstrator of anatomy in the Medical College of Ohio at Cincinnati, and two years later professor of pathological anatomy in the Cincinnati Medical College. Here he delivered the first systematic course of lectures on "Morbid Anatomy" ever given in the United States; and while occupying this chair he published the first methodical treatise on that subject on this side of the Atlantic, or in the English language. In 1850 he lectured at the University of New York, and in 1856 was elected professor of surgery in the Jefferson Medical College, which position he held until his death. He was a voluminous writer, and was always an able supporter of medical societies and associations for the advancement of medicine or the promotion of sanitary knowledge. He received the honorary degree of LL. D. from Jefferson college, Philadelphia, and in 1872, on the occasion of his second visit to Europe, the University of Oxford, on its one thousandth commemoration, conferred upon him the honorary degree of D. C. L. At the meeting of the International Medical Congress in Philadelphia, in 1876, he was unanimously elected its president.

Hillary Ryan, the fifth son of Zachariah and Eleanor Ryan, who were from South Carolina, was born at Greensboro', Alabama, Dec. 11, 1822. His mother died when he was nine years of age, and his father never afterwards married. In November, 1832, he moved with his father from the place of his birth to Noxubee county, Miss., where he remained till 1840, and then moved to Lafayette county, Ark. Although possessed of independent means, his father thought it essential that every boy should be taught manual labor, and kept him at work on the farm every spring, sending him to school at Macon, Miss., through the summer, autumn, and winter months. When at work on the farm his thirst for knowledge was so great that he always carried his Latin and Greek books tied to his plow-handles, and would occasionally look into them and memorize a verse or two as he worked. This, together with his study at night and a little instruction from an elder brother, enabled him to be up with his class when he returned to school from his father's farm. He was ever the favorite and leader in every sport and enterprise in school, and his teacher, Professor Ferris, declared him to be the most proficient pupil ever taught by him. In 1840, his father having become embarrassed by the payment of security debts, was unable to assist him.

This threw him on his own resources for the furtherance of his education, and he began an alternation of teaching and attending school and studying medicine under Dr. Lipscomb, of Macon, Miss. He continued this course till the autumn of 1843, when he went to Mobile, Ala., and attended lectures during the winter of 1843–'44. The following year his father again assisted him, and he attended lectures at New Orleans during the winter of 1844–'45, where he gained great distinction for remarkable proficiency. In 1845 he located in Louisville, Lafayette co., Ark., where he acquired a very extensive practice, often riding a distance of forty miles during a single night to visit his patients. In 1846 he removed to Washington, Hempstead co., Ark. After a residence of one year at the latter place, his attention was drawn to the great state of Texas. Thither he repaired, and located in the city of Galveston, where he remained about one year and a half. Thence he located at Caldwell, in the same state, and practised many years as partner of Dr. Henry Munson, a talented physician from New York, doing the practice for three or four counties. In 1856 he again entered the medical college at New Orleans, from which he graduated in 1857 with the first honors of a large class. While located at Caldwell, Texas, on January 1, 1850, he married Elmina Gibson, daughter of James Gibson, a wealthy planter of Washington, Ark. The fruits of his marriage were five sons and five daughters, six of whom—two sons and four daughters—and his wife, survive him.

After his graduation in 1857 he located at Austin, Texas, from which point he entered the Confederate army as captain of Company D, in Col. Allen's regiment. Soon afterwards he resigned his captaincy to accept the position of surgeon of the command, the duties of which he continued to discharge till the close of the war. At the close of the war he returned to Caldwell, Texas, and maintained an overwhelming practice till the failure of his health from an injury received in being thrown from his buggy in 1882. Thinking the atmosphere of western Texas might be more congenial to his health, he moved to Colorado City, January 1, 1884, where he accepted the consultation department in the practice of Dr. A. R. Smith, of that place, a graduate of Bellevue college. On the 18th day of May, 1884, he arose feeling as well as usual. About one o'clock of that day he was called upon by Dr. Smith to administer chloroform to a lady who desired a tooth drawn. After giving the chloroform, he asked to be allowed to draw the tooth. When he had drawn the tooth almost out, he suddenly fell forward upon the floor, and expired in a few seconds without speaking. Truly he "died in the harness."

He was a surgeon of wide reputation, being frequently called a great distance to perform operations. He performed many novel and capital operations, the products of many of which may be seen in different medical colleges of this country. He was a consistent member of the Baptist church from his early youth, was a Royal Arch Mason for more than thirty years, an Odd Fellow, a fifth degree member of the American Legion of Honor, a member of the state societies and of the American

Public Health Association. He was scrupulously charitable, never having charged for his services or medicine to a minister of the gospel, or a widow without independent income. He claimed that to be the sacred injunction he received from his dear old father. He was a hard student all his life, was thoroughly familiar with all scientific subjects, was perfectly versant with the Latin, Greek, French, and Spanish languages, and possessed one of the finest medical libraries in the state.

R. J. Farquharson, M. D. On the 7th day of September, 1884, the papers of the city of Des Moines, Iowa, chronicled the death of Robert J. Farquharson, M D., secretary of the Iowa State Board of Health. Thus passed away one of nature's noblemen—an accomplished physician, a profound scholar, a constant student, a devoted patriot. Dr. Farquharson was born in Nashville, Tenn., July 15, 1824. His father was a Scotchman and his mother a Kentuckian, both of whom came to Nashville at an early day. His literary education was conducted in the Nashville University, from which school he graduated in 1841. Soon after, he began the study of medicine, attending medical lectures in the University of Pennsylvania, and in due time came up for his examinations for the degree of Doctor of Medicine. His examinations were pronounced satisfactory, but being but twenty years old he could not fulfil the requirement of age, and he applied for the examination for resident physician in Pennsylvania Hospital (Blockley), which he also passed, with the very unusual compliment of the endorsement of every member of the medical department of the university. As soon as he had reached his majority he was awarded the diploma which he had so honorably won.

In 1845 he removed to the city of New Orleans, La., where he began the practice of medicine. Two years later (1847) he received the appointment of assistant surgeon to the United States navy: the following year he took his examinations as passed assistant surgeon. During his service as surgeon in the United States navy, the doctor was assigned to vessels whose voyages carried him to the ports of nearly every civilized nation of the world. Taking advantage of his opportunities, he studied the habits and characteristics of different nations and peoples, and probably no man of his age was possessed of more varied information on subjects pertaining to political economy, or questions of sanitary science, than he. While cruising off the coast of Africa he suffered severely from malarial toxemia, and found that his hearing was being impaired. The difficulty increased so as to materially interfere with the comfortable performance of his professional duties. In 1855 he resigned his commission (having been ten years in the naval service of the United States), and came home to Nashville. During this year (1855) he was married to Miss Lydia Smith, a granddaughter of Dr. Felix Robertson, an early graduate of the University of Pennsylvania, and one of the founders of the city of Nashville.

During the war of the Rebellion Dr. F. remained faithful to the Union,

saying that he "could never break the oath of allegiance he had taken to the United States, although it should estrange him from life-long friends and relatives." When Morgan made his memorable raid through Tennessee he searched diligently for the renowned "Union doctor," whom he did not find, but whose buildings and property he destroyed. The doctor, with a faithful servant, had secreted himself in the fields and woods, where he eluded his pursuers until an opportunity presented, and he escaped to Cincinnati. After the state of Tennessee came again into Federal control, Dr. F. returned to Nashville, and was appointed surgeon of the "Andy Johnson regiment." In August, 1864, he was appointed assistant surgeon at the United States military railroad hospitals at Nashville, where he remained until the close of the war.

As already intimated, Dr. Farquharson was possessed of fine scholarly and literary tastes. He was a member of the British Society for the Advancement of Science; American Society for the Advancement of Science; Anthropological Society, Washington, D. C.; American Public Health Association; Sanitary Council of the Mississippi Valley; Davenport Academy of Sciences; Institution Ithnographique, Paris; Iowa State Medical Society; Polk County (Iowa) Medical Society; Iowa Academy of Sciences.

In 1868 Dr. Farquharson came to Davenport (Iowa), and engaged in the practice of medicine, though he devoted much time to scientific pursuits, particularly the study of archæology, in which science his writings are authority. He was an active and enthusiastic member of the Academy of Sciences at Davenport, and did much valuable work in that organization, filling at different times, with great acceptance, the offices of librarian and president. He was an extensive writer on medical and sanitary subjects, and his productions were always honored with the closest attention from the audiences for which they were prepared.

In 1881 the doctor was elected secretary of the Iowa State Board of Health, which office he held until the time of his death. The members of the Iowa State Board of Health feel very deeply his loss. He was encyclopedic in his knowledge, and kept himself abreast with every sanitary question. He was a great reader, and possessed of a fund of statistics truly astonishing. Though extremely modest, yet he was decided in his opinions, and his suggestions to the board of health were marked by a clearness and wisdom which showed most patient and painstaking research on every question presented for consideration. When asked an opinion on any sanitary or hygienic question, it was given with such scientific accuracy that the members of the board felt that he had these subjects well in hand, and he discussed all matters of public health as though he had been specially studying them for the information desired. He was a man of remarkable patience, and a good listener; and no matter how radically he differed with a speaker, he was courteous and tolerant on all occasions. In his death this association loses one of its most interested and faithful members, the state an honored, high minded, and worthy citizen, the Iowa State Board of Health a

most efficient and beloved secretary, and his family a devoted husband and father.

In reporting the death of Surgeon JOSEPH JANVIER WOODWARD, U. S. A., your committee would respectfully ask your attention to the official announcement of Surgeon-General Murray, who faithfully offers a tribute of respect to his memory, and suitably notices his distinguished career:

WAR DEPARTMENT,

SURGEON-GENERAL'S OFFICE,

WASHINGTON, D. C., August 20, 1884.

In announcing to the officers of the medical department the death of Joseph Janvier Woodward, Surgeon and Brevet Lieutenant Colonel, U. S. A., which occurred near Philadelphia, Penn., August 17, 1884, the surgeon-general wishes to offer his tribute of respect to the memory of the deceased, whose distinguished career and valuable services for a period of twenty-three years have shed lustre on the corps, and for whose untimely loss feelings of profound regret will be shared alike by his comrades in arms and by the profession at large.

Dr. Woodward was born in Philadelphia, Penn., October 30, 1833, and was educated at the Central high school of that city, graduating with honor as Bachelor of Arts in 1850, and receiving the degree of Master of Arts from the same institution in 1855. He graduated in medicine at the University of Pennsylvania, April, 1853; entered the army as assistant surgeon August 5, 1861; became captain and assistant surgeon July 28, 1866; major and surgeon June 26, 1876. "For faithful and meritorious services during the war" he received the brevets of captain, major, and lieutenant-colonel U. S. Army.

He was assigned to duty in this office May 19, 1862, and from that date until the beginning of the illness which terminated in his death was intimately identified with its professional and scientific work.

While the valuable results of his life's labor are comprehended in a long list of miscellaneous publications, both professional and scientific, too familiar to the corps to require individual mention, his greatest triumphs were won in the field of microscopical investigation in normal and pathological histology, and in his happy application of photomicrography to the purposes of science. In these pursuits he attained remarkable success, and achieved an enviable, world-wide reputation, leaving to science and to medicine lessons of undoubted value and usefulness. Of his strictly professional work, the medical portion of the Medical and Surgical History of the War of the Rebellion was the crowning achievement. In the second part of this work he developed the results of his careful investigations into the nature and pathology of the intestinal diseases which had proved so fatal in the late war. Here, also, he displayed his wonderful capacity for that minute and exhaustive research which forms so striking a feature of his writings. As in the case of his colaborer Otis, he yields to other hands the honor of completing his labors.

In addition to his engrossing professional duties, his restless activity of mind led him to seek recreation in his favorite studies—physics, art, and philosophy. Endowed with a retentive memory, and of untiring industry, he acquired a vast store of information which he held available for use at will. Fluent of speech, he took delight in the expression of his views and opinions, both in social converse and in the arena of scientific debate. His fund of knowledge, his strong convictions, his tenacity of opinion, and his quick perception made him a controversialist of no low order.

With such a record, it is needless to speak of his zeal, his ambition, or his devotion to his profession, and especially to the reputation of the corps of which he was so bright an ornament.

Of a sensitive, highly strung, nervous organization, the confinement, anxiety, and labor to which he was subjected in his attendance upon the late President Garfield during his long illness proved too much for a mind and body already overstrained by incessant labor, and precipitated the illness which finally terminated his life.

At the time of his death, Dr. Woodward was a member and ex-president of the American Medical Association, a member and ex-president of the Washington Philosophical Society, a member of the National Academy of Science, of the Association for the Advancement of Science, of the Academy of Natural Sciences of Philadelphia, and of the College of Physicians and Surgeons of Philadelphia. He was an honorary member of several American and foreign scientific, medical, and microscopical societies, and the recipient of many distinguished honors from learned bodies in this country and abroad.

R. MURRAY,
Surgeon-General U. S. Army.

Dr. Warren Stone, son of the late Dr. Warren Stone, Sr., died at his residence in New Orleans at 4:15 A. M., January 3, 1883. For two or three months previous he had been in bad health, but was at his office and attending to his professional duties the day before his death. He died suddenly and painlessly, with what appeared to be sudden failure of the heart. He had been lying on his bed engaged in conversation with his wife, who was sitting beside him, when he arose, and walked across the room. When about to lie down again, he fell, and immediately expired.

Dr. Stone was born in the city of New Orleans in 1843. He received his education at the Jesuit's College in that city, but, owing to the breaking out of the war between the states, did not remain to complete the curriculum of that institution. Although not eighteen years of age at the commencement of hostilities, he was one of the first to offer his services to his state, enlisting in the Fifth Co. Washington Artillery, and serving until the surrender of the Confederate forces.

Having intended following the profession of his honored father, and having been closely associated even in his youth with medical men and surroundings, and showing a liking for surgery, he was detailed during the latter part of the war for hospital duty; and it was here that his medical education may be said to have begun.

Upon his return to New Orleans, he immediately began regular study in his chosen profession, matriculating at the medical department of the University of Louisiana, from which institution he graduated with high honors in the spring of 1867, having been chosen the valedictorian of his class. Entering immediately into practice, his success was almost phenomenal, and he bade fair to become one of the leading surgeons of the South-west. Up to within one year of his death he gave his services to the charity hospital in the capacity of visiting surgeon, performing many operations, but never an unnecessary one. His judgment was almost unerring, and it was this quality, coupled with his remarkable skill as a diagnostician, which early earned for him the reputation which he so justly deserved. He was strictly a conservative surgeon, and would never amputate a limb if he thought there was the remotest chance of its being saved, nor perform any operation unless he felt assured that it would result in benefit to his patient. He would never operate for the mere sake of operating. He devoted a great portion of his time to the study of *aneurism*, and in his conversations with his *confrères* (and he

was a brilliant conversationalist when his interest was aroused), this was his favorite theme.

In 1873 a case of traumatic aneurism of the subclavian artery came under his observation, and he concluded to try digital compression for its cure. With the assistance of five or six of his professional brethren (of whom the writer was one), digital compression was made on the distal side of the artery immediately beyond the aneurism. Compression was kept up for thirty-six hours, with the result of perfect cure, the patient being alive and well at this writing, over eleven years after the treatment. This, the writer believes, was the first case on record of cure of subclavian aneurism by distal digital compression.

At the opening of the Charity Hospital Medical College of New Orleans in 1874, Dr. Stone was called to the chair of surgical anatomy, and lectured regularly to its students until the close of the college.

Upon the appearance of an epidemic of yellow fever in Brunswick, Ga., in 1874, he offered his services to that stricken community, and worked faithfully and unceasingly throughout the epidemic.

In 1878, when yellow fever was raging with unprecedented violence throughout the South-west, he left his home, regardless of the large practice he was leaving behind (there were others, skilled in the treatment of the disease, who could attend to that), and travelled about from one stricken town or village to another, giving his services gratuitously to the afflicted throughout Louisiana and Mississippi. This arduous, self-imposed task proved almost too much for even such a robust constition as his, and he was compelled, after the epidemic had subsided, to go into the country for rest and recuperation.

Although never publicly engaged in sanitary affairs, he always evinced a lively interest in matters pertaining to public health, and in 1880, at its meeting in New Orleans, he became a member of the American Public Health Association.

There was no greater favorite among the medical fraternity of New Orleans than Dr. Warren Stone, both as a man and as a surgeon, and both in the profession and out of it he was universally admired. He was without an enemy: every one admired him for all those qualities which constitute a true gentleman. He was in every sense of the word one of "nature's noblemen," and in his friendships as true and firm as steel. He was generous to a fault, kind and sympathetic to all without regard to rank or station, and would give his professional services to the poor, the humble, and the lowly without hope of fee or reward as willingly as to the wealthy. He was the very exemplification of honor, unselfishness, and truthfulness, and he scorned a mean action as he approved a worthy one. Besides, he was an earnest and patriotic citizen, who offered his services to his state on the first note of war, and who never failed to interest himself in the affairs of state, and to perform his duties as a citizen faithfully and fully.

As has been truly said of him,—"No man ever possessed firmer and more loving friends than he, and none ever deserved them more." He died as he had lived, honored and loved by all who knew him.

Frederick D. Lente, M. D., was born in Newbern, N. C., in 1823, and was a graduate of the university of that state, as well as of the University Medical College of New York. In 1851 he was appointed surgeon of the West Point foundry at Cold Spring, N. C., filling that responsible position until 1870, when he removed to New York, having been appointed to the chair of gynecology and diseases of children at the University Medical College. In less than a year his health failed, and he was obliged to resign his position in the college, and afterwards he continued his professional labor at Palatka, Fla., during the winter, and at Saratoga Springs during the summer months, of each year.

Dr. Lente was one of the founders of the American Academy of Medicine, and was its first president. He was also a member of the Neurological, the Pathological, the New York, and the Dutchess County medical societies, the American Public Health Association, at the meetings of which he had contributed papers, was one of the board of managers of the Hudson River State Hospital, corresponding member of the New York Medico-Legal Society, and honorary member of the North Carolina Medical Society. He died October 11, 1883.

Dr. Willard Parker, of New York, was born in New Hampshire in 1800, removed to Massachusetts when quite young, and graduated at Harvard in 1826. He pursued the study of medicine in Boston, graduating from the Harvard Medical College in 1830, and was appointed to the chair of anatomy in the Berkshire Medical College at Pittsfield, Mass., the same year. He also lectured on anatomy at Woodstock, Vt., the same year. In 1836 he was appointed to the chair of surgery in the Cincinnati Medical College, but soon after left Cincinnati to visit the medical institutions of Europe, and on his return he located in New York, and in 1839 was appointed to the chair of surgery in the College of Physicians and Surgeons.

In 1845 the city alms-house was reorganized, and became a part of the present Bellevue hospital, and Drs. Parker and Janes R. Wood were appointed visiting surgeons. He received the degree of LL. D. from the College of New Jersey at Princeton in 1870.

While he was never considered a book-maker, yet he contributed many valuable papers to the literature of the profession, and the reports of his cases have always been considered valuable acquisitions to the library of any medical man. He enjoyed the entire confidence of his professional friends, and was the professional friend and counsellor of a large circle of patrons, whose confidence in his ability was only equalled by the success which attended his professional work. His death occurred in 1884.

Charles Walter Chamberlain, of Hartford, Conn., was born in Providence, R. I., in 1844, received his education at Brown University and at the College of Physicians and Surgeons of New York, graduating as an M. D. in 1871. The same year he located in the city of Hartford, making a specialty of laryngology.

In 1876 he became secretary of the Connecticut State Medical Society, and contributed very much towards its advancement.

Soon after locating in Connecticut, he became a strong advocate of the state's assuming control of matters of hygiene, and, supporting his convictions with a conscientious regard for the true welfare of the public, he had the great pleasure of witnessing the enactment of a law establishing a state board of health, and of being chosen its executive officer, the office of secretary, which he held at the time of his death. He was sincerely beloved by all who knew him, and as a member of this association he was always active in promoting its advancement.

At the time of his death he was a member of the advisory council, and chairman of the conference of state boards of health. This conference was mainly brought about through his efforts, as he was a firm believer in unity of action, which could only be brought about by associated effort, and entire harmony between health officers.

No words of ours can better express the respect and confidence in which he was held by his friends and associates than the following tribute to his memory that is inscribed upon the records of the state board of health of Connecticut by the surviving members of the board, and therefore we append them in full:

CONNECTICUT STATE BOARD OF HEALTH,
NEW HAVEN, Ct., September 13, 1884.

Dr. Lindsley submitted the following minute, which was directed to be recorded:

In entering on the records of the state board of health the death of its late secretary, Charles Walter Chamberlain, M. D., which occurred August 13, the members of the board desire to express a deep sense of the abiding loss thereby sustained, and especially to make an entry of the high appreciation in which they held him for his sterling worth, his manliness of character, and his earnest devotion to the cause in which he had enlisted the best energies of his life.

His late associates would bear witness that the Connecticut State Board of Health is largely the product of his personal efforts, both in its origin and in its growth; that by his quiet zeal tempered by prudence, by his persistent industry made effective by good judgment, by his scientific attainments, and his broad and just views upon public sanitation, he has contributed more than any other individual to create and fix in the political economy of this state a new institution, scarcely inferior to any other in its relations to the welfare and prosperity of the commonwealth; that, although cut off in the midst of a very earnest and very useful life, Dr. Chamberlain has left a name honored in his profession, distinguished in the specialty to which he was devoted, and holding a place in our memories which we shall always cherish with sentiments of esteem and respect.

Dr. WILLIAM FRANCIS SHEEHAN was born in County Limerick, Ireland, February 12, 1855. Having received a liberal education, he came to this country in 1874, and commenced the study of medicine with his uncle, Dr. J. W. Casey, of Rochester. He graduated in 1877 at the Buffalo (N. Y.) Medical College with marked honors, taking several prizes for proficiency in various branches. In the same year he engaged in private practice in Rochester, and on April 20, 1880, married Miss Katie L. Kramer, daughter of one of Rochester's most respected citizens. Becoming a member of the Monroe County Medical Society May

30, 1877, he was in the following year made a delegate to the Medical Association of Central New York, which place he filled for two years. The county society in 1880 elected him delegate to the American Medical Association, and in 1882 he went in a similar capacity to the New York State Medical Society. From 1880 to 1882 he was secretary of the Monroe County Medical Society, which position he filled with honor to himself and with benefit to the society. During this time he served on a committee of the society to prosecute illegal practitioners. October 12, 1877, he became a member of the Rochester Pathological Society, and soon thereafter was elected secretary, and, later, president of the organization. He has held medical offices of responsibility with never varying faithfulness and ability. Appointed by the common council in 1878, he held the office of city physician for one year. The board of supervisors in 1880 chose him to be coroner's physician for that year, and in 1882 he was made health officer of the city. Talented and zealous in his official capacity, he was reappointed in 1883, and during his two years of service as guardian of the public health he was instrumental in bringing about many changes for the better in the city's sanitation. His deep research, his untiring devotion to the subject in all its bearings, frequently sacrificing his time, his rest, and his private interests to the demands of the office, and his clear-headed comprehension of the details of sanitary science, make it a well known and generally admitted fact that he was the best health officer the city ever had. Ever an earnest worker in the interests of medical science, his contributions to the fund of medical knowledge comprised papers on the "Anatomy of Club-Foot," "The Anatomy of President Garfield's Wounds," "Fractures near the Elbow Joint," "Vesico-vaginal Fistula," "Chicken-pox," "The Statistics of Diphtheria," "House Sanitation," "School Hygiene," "Filth as a Cause of Disease," etc. Through the medium of the public press he did much to educate the masses on the causes and prevention of cholera infantum. Thoroughly conversant with the anatomy of the human body, he for some time conducted a class in practical anatomy. He was a member of the Rochester Academy of Science, and president of its anatomical section. His lectures before this body were spoken of in the highest terms of commendation. The Kindergarten movement in this city three years ago received his warm support, and he was one of the originators and promoters of the scheme to establish a hospital at the lake shore for sick children. A true lover of his profession, he had during his brief medical career built up a large and lucrative general practice. His tender interest in the welfare of his patients, his charity to those whose circumstances were not of the best, his Christian spirit and quiet, unassuming manner, caused the deepest attachments to exist between him and a large circle of friends. He was a devout member of St. Patrick's Roman Catholic cathedral, and while he made no outward show of his religion, it was a potent element in influencing his life and daily demeanor. In politics he was a Democrat, and at the time of his death was president of the Young Men's Independent Democratic Club.

On the morning of Tuesday, July 22, 1884, he was called to attend a confinement. He left home apparently in the best of health and spirits, full of hopefulness for the future. The case to which he went was a long, tedious labor, and he spent the day at the house of his patient, completing the delivery with forceps at nine in the evening. Immediately thereafter, while he was making ready to leave the house, he was seized with an intense pain in his head, and in a few minutes became unconscious. Medical aid was at once summoned, but he remained unconscious until his death, which occurred at 2 A. M. from rupture of a vessel and pressure on the medulla oblongata. It can be truly said of him that he died in the harness. His last act in life was in the following of that profession to which he had devoted himself with such untiring fidelity. There can be no question that the remote yet immediate cause of his death was overwork in his chosen calling. His ambition, his thoroughness in all he undertook, his ceaseless labors for the relief of suffering, were too much for his vital powers, and he truly sacrificed his life for the lives of others. The whole community received a great shock in the news of his death, and a feeling of general grief and depression pervaded the city. His young wife, with her infant son, and his aged parents in a distant land, will receive the sincerest sympathy of all in their sudden, sad bereavement. The city loses a good citizen, society mourns a favorite and beloved son, and the medical profession is deeply sensible that one of its brightest and ablest young men has been removed, and his promising career cut short in the very fulness of its bloom.

On the evening preceding the day of his death, he wrote a letter to the president of the American Public Health Association, of which he was a member, in regard to the part he should take in the work of the approaching session. He was deeply interested in the work of the association, and in laying before that body these few words in memory of the departed, the writer feels that he can pay but a scant tribute to the many good qualities of a dear friend, a noble man, and a good physician.

John Josiah Holbrook, A.M., who was elected a member of the American Public Association November 13, 1883, died from peritonitis at his home in Keene, N. H., March 24, 1884. He was the only son of Daniel Hill and Caroline Lawrence (Prime) Holbrook, and was born in Swanzey, N. H., December 10, 1844.

The elements of his education were acquired in the common schools of his native town. His innate thirst for knowledge, united with an acute perception of its advantages, early made him a diligent student, while the cultivation of a mind naturally broad and vigorous rendered him a superior scholar. He studied at the Keene high school, the Leland & Gray Seminary, Townshend, Vt., and Colby Academy, New London, N. H., where he fitted for college. He graduated at Brown University in 1872. In college he maintained a high rank, and developed to a marked degree his inherited genius for mathematics and natural science.

In religious faith he was a Baptist, and sacrificed many ambitions when he decided to prepare for the ministry. He graduated at Newton Theological Seminary in 1875, and became professor of natural science and mathematics at New London for the ensuing two years, when he removed to Keene, and successfully followed the profession of a civil engineer until his death.

Mr. Holbrook was not content to perform only the ordinary duties of his profession. Of a scholarly mind, he pursued general knowledge with constant zeal. Conscientious, high minded, and public spirited, he found his enjoyment in the attainment of truth, and its application for the benefit of others. Especially interested in sanitary matters, it was his aim to become an authority upon all subjects relating thereto, and he regarded his membership in this association with great satisfaction, and as in some sense a reward. Of fine presence and gentlemanly deportment, manly and modest, he was a social favorite, always genial, often witty, and never tedious. A fine linguist, he was the author of numerous newspaper articles upon subjects of public interest, many of which ranked as essays. Of deep religious convictions, he was everywhere conspicuous in Christian labor. Possessed of a singular sense of honor, he never knew fear or favor. He sought noble ends by noble means.

Though never married, he was domestic in his nature, and was ever faithful to the home life he enjoyed with his father and sister. As a citizen, he was respected and honored. His sudden death was a great shock to the community in which he lived, and was a public loss.

ANNUAL REPORT OF DR. J. BERRIEN LINDSLEY,

Nashville, Tennessee, Treasurer of the American Public Health Association, October 14, 1884.

RECEIPTS.

Balance brought forward,	$1,281.28	
From sale of *Public Health*,	163.88	
From annual fees of members,	1,455.00	
Total,		$2,900.16

DISBURSEMENTS.

Paid for printing, binding, and distributing Vol. IX of *Public Health*,	$1,146.81	
Paid president's postage and stationery,	25.00	
Paid on account of former secretary's printing and stationery,	204.13	
Paid secretary's postage, printing, and stationery,	166.10	
Paid treasurer's postage and help,	55.99	
Paid treasurer's travelling expenses,	56.60	
		$1,654.63
Cash on hand,		$1,245.53

The above expenditures were ordered by the Executive Committee, and vouchers for the same are herewith submitted.

J. BERRIEN LINDSLEY.

ST. LOUIS, October 15, 1884.

TO THE PRESIDENT OF THE A. P. H. ASSOCIATION:

Sir:—The undersigned, an Auditing Committee appointed to audit the treasurer's account for the year ending October 14, 1884, respectfully report that they have examined the vouchers, and find the same correct.

Respectfully submitted.

GUSTAVUS DEVRON.
WM. BAILEY.
A. N. BELL.

CONSTITUTION

OF THE

AMERICAN PUBLIC HEALTH ASSOCIATION.

TITLE.

I. This association shall be called "THE AMERICAN PUBLIC HEALTH ASSOCIATION."

OBJECTS.

II. The objects of this association shall be the advancement of sanitary science, and the promotion of organizations and measures for the practical application of public hygiene.

MEMBERS.

III. The members of this association shall be known as Active and Associate. The Executive Committee shall determine for which class a candidate shall be proposed. The *Active* members shall constitute the permanant body of the association, subject to the provisions of the constitution as to continuance in membership. They shall be selected with special reference to their acknowledged interest in or devotion to sanitary studies and allied sciences, and to the practical application of the same. The *Associate* members shall be elected with special reference to their general interest only in sanitary science, and shall have all the privileges and publications of the association, but shall not be entitled to vote. All members shall be elected as follows:—

Each candidate for admission shall first be proposed to the Executive Committee, in writing (which may be done at any time), with a statement of the business or profession, and special qualifications, of the person so proposed. On recommendation of a majority of the committee, and on receiving a vote of two thirds of the members present at a regular meeting, the candidate shall be declared duly elected a member of the association. The annual fee of membership in either class shall be five dollars.

OFFICERS.

IV. The officers shall be a President, a First and Second Vice-President, a Secretary, and a Treasurer.

All the officers shall be elected by ballot, annually, except the Secretary, who shall be elected for a term of three years.

PRESIDING OFFICER.

V. The President, or, in his absence, one of the Vice-Presidents, or, in their absence, a Chairman *pro tempore*, shall preside at all meetings of the association. He shall preserve order, and shall decide all questions of order, subject to appeal to the association. He shall also appoint all committees authorized by the association, unless otherwise specially ordered.

SECRETARY.

VI. The Secretary shall have charge of the correspondence and records of the association; and he shall also perform the duties of Librarian. He, together with the presiding officer, shall certify all acts of the association. He shall, under the direction of the Executive Committee, give due notice of the time and place of all meetings of the association, and attend the same. He shall keep fair and accurate records of all the proceedings and orders of the association; and shall give notice to the several officers, and to the executive and other committees, of all votes, orders, resolves, and proceedings of the association, affecting them or appertaining to their respective duties.

TREASURER.

VII. The Treasurer shall collect and take charge of the funds and securities of the association. Out of these funds he shall pay such sums only as may be ordered by the association, or by the Executive Committee. He shall keep a true account of his receipts and payments, and at each annual meeting render the same to the association, when a committee shall be appointed to audit his accounts. If from the annual report of the Treasurer there shall appear to be a balance against the treasury, no appropriation of money shall be made for any object but the necessary current expenses of the association, until such balance shall be paid.

COMMITTEE.

VIII. There shall be a Standing Committee, to be known as "The Executive Committee," which shall consist of the President, the First Vice-President, Second Vice-President, Secretary, and Treasurer, and six members annually elected by ballot.

All committees, and all members preparing scientific reports or papers to be laid before the association, at its annual meetings, must give, in writing, the title of such reports or papers, the time to be occupied in reading them, and an abstract of their contents, to the Executive Committee, at least one week preceding the date of such meeting, to secure their announcement in the order of business.

EXECUTIVE COMMITTEE.

IX. It shall be the duty of the Executive Committee to consider and recommend plans for promoting the objects of the association; to author-

ize the disbursement and expenditure of unappropriated moneys in the treasury for the payment of current expenses; to consider all applications for membership, and at the regular meetings report the names of such candidates as a majority shall approve; and, generally, to superintend the interests of the association, and execute all such duties as may from time to time be committed to them by the association. At least one month preceding the annual meeting of the association, the Executive Committee shall cause to be issued to members a notice of such meeting, and they are authorized to publish the same in medical, scientific, and other periodicals, but without expense to the association;—such notice shall contain the order of business to be followed at said meeting, and, briefly, the subjects to be presented, and the special points of discussion.

MEETINGS.

X. The time and place of each annual meeting shall be fixed at the preceding annual meeting, but may be changed by the Executive Committee for reasons that shall be specified in the announcement of the meeting. Special meetings may be called, at any time or place, by concurrence of two thirds of the Executive Committee. There shall be no election of officers, or change of by-laws, or appropriation of money to exceed the amount at that time in the treasury, at such special meeting, except by a vote of a majority of all the members of the association. Whenever a special meeting is to be held, at least one month's notice shall, if possible, be given by circular, to all the members, together with the order of business.

QUORUM.

XI. At the annual meeting nine members shall constitute a quorum for the election of officers, a change of the constitution, the election of members, and the appropriation of moneys.

ORDER OF BUSINESS.

XII. The order of business at all meetings of the association shall be fixed by the Executive Committee, and such order must be completed before any other business is introduced, except such order of business is suspended by a vote of four fifths present.

ALTERATION OF CONSTITUTION.

XIII. No alteration in the constitution of the association shall be made except at an annual meeting, and unless such alteration shall have been proposed at a previous meeting, and entered on the minutes with the name of the member proposing the same, and shall be adopted by a vote of two thirds of the members present.

OFFICERS AND COMMITTEES

OF

THE AMERICAN PUBLIC HEALTH ASSOCIATION.

ORGANIZATION, 1884–1885.

President	Dr. JAMES E. REEVES, Wheeling, W. Va.
First Vice-President . . .	Hon. ERASTUS BROOKS, West New Brighton, Staten Island, N. Y.
Second Vice-President . .	Dr. HENRY B. BAKER, Lansing, Mich.
Secretary	Dr. IRVING A. WATSON, Concord, N. H.
Treasurer	Dr. J. BERRIEN LINDSLEY, Nashville, Tenn.

(*Ex-officio* Members Executive Committee.)

STANDING COMMITTEES.

EXECUTIVE COMMITTEE.

(Elective.)

Dr. HENRY P. WALCOTT	Cambridge, Mass.
Major CHARLES SMART, U. S. A.	Washington, D. C.
Dr. G. B. THORNTON	Memphis, Tenn.
Dr. D. W. HAND	St. Paul, Minn.
Dr. GUSTAVUS DEVRON, ...	New Orleans, La.
Dr. H. B. HORLBECK	Charleston, S. C.

ADVISORY COUNCIL.

The PRESIDENT, *ex-officio*.

Alabama	Dr. R. D. WEBB, *Livingston*.
Arkansas	Dr. J. A. DIBRELL, *Little Rock*.
California	[1]Dr. F. W. HATCH, *Sacramento*.
Colorado	Dr. CHARLES AMBROOK, *Boulder*.
Connecticut	Prof. C. A. LINDSLEY, *New Haven*.
Delaware	Dr. L. P. BUSH, *Wilmington*.
Florida	Dr. ROBERT B. S. HARGIS, *Pensacola*.
Georgia	Dr. W. H. ELLIOTT, *Savannah*.
Illinois	Prof. HOSMER A. JOHNSON, *Chicago*.
Indiana	Dr. E. S. ELDER, *Indianapolis*.
Iowa	Dr. W. S. ROBERTSON, *Muscatine*.

[1] Deceased.

Kentucky	Dr. Pinckney Thompson, *Henderson*.
Louisiana	Dr. S. S. Herrick, *New Orleans*.
Maine	Dr. C. G. Adams, *Portland*.
Maryland	Prof. George H. Rohé, *Baltimore*.
Massachusetts . . .	Dr. S. H. Durgin, *Boston*.
Michigan.	Dr. Foster Pratt, *Kalamazoo*.
Minnesota	Prof. C. N. Hewitt, *Red Wing*.
Mississippi	Dr. Wirt Johnston, *Jackson*.
Missouri	Dr. Joseph Spiegelhalter, *St. Louis*.
New Hampshire . .	Dr. Granville P. Conn, *Concord*.
New Jersey	Dr. W. K. Newton, *Paterson*.
New Mexico . . .	Dr. W. T. Parker, U. S. A., *Ft. Union*.
New York	Dr. Joseph H. Raymond, *Brooklyn*.
North Carolina. . .	Dr. Thomas F. Wood, *Wilmington*.
Ohio	Dr. R. Harvey Reed, *Mansfield*.
Pennsylvania . . .	Crosby Gray, Esq., *Pittsburgh*.
Rhode Island . . .	Dr. Charles H. Fisher, *Providence*.
South Carolina . . .	Dr. T. Grange Simons, *Charleston*.
Tennessee	Col. D. P. Hadden, *Memphis*.
Texas	Dr. R. M. Swearingen, *Austin*.
Vermont	Hon. Henry D. Holton, *Brattleborough*.
Virginia	Prof. J. L. Cabell, *University of Va*.
West Virginia . . .	Dr. T. A. Harris, *Parkersburgh*.
Wisconsin	Dr. J. T. Reeve, *Appleton*.
District of Columbia .	Maj. Samuel A. Robinson, *Washington*.
U. S. Army	Maj. George M. Sternberg, *Baltimore*, *Md*.
U. S. Navy	Medical Director Albert L. Gihon, *Washington*, *D. C.*
U. S. M. H. Serv. .	Surg. Walter Wyman, *Baltimore*, *Md*.
Bureau of Education .	Hon. John Eaton, Commissioner, *Washington*, *D. C.*

PUBLICATION COMMITTEE.

The Secretary, *ex-officio*.

Dr. Samuel H. Durgin . . . . Boston, Mass.
Dr. Granville P. Conn . . . . Concord, N. H.

SPECIAL COMMITTEES.

ON STATE BOARDS OF HEALTH.

Dr. G. P. Conn, President State Board of Health, *Concord*, *N. H.*
Hon. Erastus Brooks, Member State Board of Health, *West New Brighton*, *Staten Island*, *N. Y.*
Dr. J. T. Reeve, Secretary State Board of Health, *Appleton*, *Wis.*
Dr. Joseph Holt, President State Board of Health, *New Orleans*, *La.*
[1] Dr. J. G. Thomas, President State Board of Health, *Savannah*, *Ga.*
Dr. G. B. Thornton, Member State Board of Health, *Memphis*, *Tenn.*
Dr. C. N. Hewitt, Secretary State Board of Health, *Red Wing*, *Minn.*
[1] Dr. F. W. Hatch, Secretary State Board of Health, *Sacramento*, *Cal.*
Dr. Peter H. Bryce, Secretary Prov. Board of Health, *Toronto*, *Ont.*

[1] Deceased.

ON SCHOOL HYGIENE.

Prof. D. A. Sargent	Cambridge, Mass.
Dr. Samuel W. Abbott	Wakefield, Mass.
Prof. J. Madison Watson	Elizabeth, N. J.
Dr. E. S. Elder	Indianapolis, Ind.
Hon. John Eaton	Washington, D. C.
Prof. Edw. M. Hartwell	Baltimore, Md.
Dr. Felix Formento	New Orleans, La.

ON ANIMAL DISEASES AND ANIMAL FOODS.

Dr. J. M. Partridge	South Bend, Ind.
Dr. Ezra M. Hunt	Trenton, N. J.
Prof. James Law	Ithaca, N. Y.
Dr. D. E. Salmon, V. S.	Washington, D. C.
Dr. John H. Rauch	Springfield, Ill.
Dr. Henry P. Walcott	Cambridge, Mass.
Lt. Col. Joseph R. Smith, U. S. A.	San Antonio, Tex.
Dr. W. B. Conery	St. Louis, Mo.
Dr. John Fee	Kansas City, Mo.

ON DISPOSAL OF THE DEAD.

Dr. John Morris	Baltimore, Md.
Rev. John D. Beugless, U. S. N.	Brooklyn, N. Y.
Dr. Felix Formento	New Orleans, La.
Dr. A. N. Bell	New York City.
Dr. William Bailey	Louisville, Ky.
Dr. James F. Hibberd	Richmond, Ind.
Dr. James A. Keller	Hot Springs, Ark.

ON DISINFECTANTS.

Maj. George M. Sternberg, U. S. A.	Baltimore, Md.
Dr. George H. Rohé	Baltimore, Md.
Maj. Charles Smart, U. S. A.	Washington, D. C.
Prof. V. C. Vaughan	Ann Arbor, Mich.
Prof. Albert R. Leeds	Hoboken, N. J.
Dr. Joseph H. Raymond	Brooklyn, N. Y.
Dr. W. H. Watkins	New Orleans, La.

ON INCORPORATION.

Dr. James E. Reeves, *President*	Wheeling, W. Va.
Dr. Irving A. Watson, *Secretary*	Concord, N. H.
Dr. J. Berrien Lindsley, *Treasurer*	Nashville, Tenn.
Medical Director Albert L. Gihon, U. S. N.	Washington, D. C.
Maj. Charles Smart, U. S. A.	Washington, D. C.
Hon. John Eaton	Washington, D. C.
Dr. Smith Townsend	Washington, D. C.
Maj. Samuel A. Robinson	Washington, D. C.

ON NECROLOGY.

The Secretary.

JUDGES OF THE LOMB PRIZE ESSAYS.[1]

I.

Dr. E. M. Moore, President State Board of Health, *Rochester, N. Y.*
Dr. C. W. Chancellor, Secretary State Board of Health, *Baltimore, Md.*
Medical Director Albert L. Gihon, U. S. N., *Washington, D. C.*
Dr. J. H. Raymond, Health Commissioner, *Brooklyn, N. Y.*
Maj. Charles Smart, Surgeon U. S. A., *Washington, D. C.*

II.

Hon. Erastus Brooks, State Board of Health, *West New Brighton, Staten Island, N. Y.*
Dr. H. P. Walcott, State Board of Health, Lunacy, and Charity, *Cambridge, Mass.*
Dr. Granville P. Conn, President State Board of Health, *Concord, N. H.*
Hon. John Eaton, Commissioner of Education, *Washington, D. C.*
Col. George E. Waring, Jr., C. E., *Newport, R. I.*

III.

Dr. S. H. Durgin, Health Officer, *Boston, Mass.*
Dr. J. E. Reeves, Secretary State Board of Health, *Wheeling, W. Va.*
Dr. Gustavus Devron, President Auxiliary Sanitary Association, *New Orleans, La.*
Prof. Richard McSherry, M. D., *Baltimore, Md.*
Prof. James M. Cabell, LL. D., *University of Virginia, Va.*

IV.

Dr. E. M. Hunt, Secretary State Board of Health, *Trenton, N. J.*
Dr. A. N. Bell, Editor *Sanitarian, New York City.*
Maj. George M. Sternberg, Surgeon U. S. A., *Baltimore, Md.*
Maj. John S. Billings, LL. D., U. S. A., *Washington, D. C.*
Mr. W. P. Dunwoody, Secretary National Board of Health, *Washington, D. C.*

[1] See page 420 for name and order of essays.

LIST OF PERSONS ELECTED TO MEMBERSHIP AT THE TWELFTH ANNUAL MEETING OF THE ASSOCIATION, HELD AT ST. LOUIS, MO., OCTOBER 14 TO 17, 1884.

ACTIVE MEMBERS.

Dr. C. G. Adams . . . . Portland, Me.
Dr. Charles W. Adams, Prof. of Surg. University . . . . Kansas City, Mo.
Dr. Adolf Alt . . . . St. Louis, Mo.
Prof. Edmund R. Angell, Principal Pinkerton Academy . . . Derry, N. H.
Dr. Legrand Atwood . . . . St. Louis, Mo.
Dr. Nahum E. Ballou . . . . Sandwich, Ill.
Dr. I. M. H. Bateman, State Board of Health . . . . Easton, Md.
Dr. G. T. Bartlett, State Board of Health . . . . Poplar Bluff, Mo.
Dr. Edwin J. Bartlett, Prof. of Chemistry, Dartmouth Coll. . Hanover, N. H.
Prof. G. Baumgarten, M. D., St. Louis Medical College . . St. Louis, Mo.
Edward Bausch . . . . Rochester, N. Y.
Dr. A. C. Bernays . . . . St. Louis, Mo.
Rev. John D. Beugless, Chaplain U. S. N. . . . . Brooklyn, N. Y.
Dr. Armin Bock . . . . St. Louis, Mo.
Dr. L. Charles Boislinière . . . . St. Louis, Mo.
Dr. L. C. Boislinière, Jr. . . . . St. Louis, Mo.
Dr. Louis Bremer . . . . St. Louis, Mo.
Dr. Charles E. Briggs . . . . St. Louis, Mo.
Dr. Daniel G. Brinton, Editor *Med. and Surg. Reporter* . Philadelphia, Penn.
Dr. Benjamin P. Brodie . . . . Detroit, Mich.
Dr. D. E. Burlingham . . . . Elgin, Ill.
Dr. G. W. Carson, Clerk Board of Health . . . . St. Louis, Mo.
Dr. J. W. Chambers . . . . Baltimore, Md.
Dr. C. G. Comegys . . . . Cincinnati, O.
Dr. T. Griswold Comstock . . . . St. Louis, Mo.
Prof. P. S. Conner . . . . Cincinnati, O.
Dr. W. C. Cook, Health Officer Davidson county . . . . . Nashville, Tenn.
Prof. H. B. Cornwall, College of New Jersey . . . . . . Princeton, N. J.
Dr. Charles W. Covernton, Chairman Prov. Board of Health . Toronto, Ont.
Dr. G. M. Cox, State Board of Health . . . . Springfield, Mo.
Dr. J. W. Craig, Ohio State Sanitary Association . . . . . . Mansfield, O.
His Excellency Thomas T. Crittenden . . . . Jefferson City, Mo.
Prof. Charles O. Curtman, M. D. . . . . St. Louis, Mo.
Dr. N. Pendleton Dandridge . . . . Cincinnati, O.
Dr. William B. Davis . . . . Cincinnati, O.
Dr. Bennett F. Davenport, Analyst State Board of Health . . Boston, Mass.
Dr. C. E. Diven, Health Officer Madison county . . . . . . Anderson, Ind.
Dr. John A. Dulaney . . . . Covington, Ky.
Wm. P. Dunwoody, Esq., Secretary Nat'l Board of Health . Washington, D. C.
Prof. L. Eddy . . . . Danville, Ky.

Dr. Joseph F. Edward, Editor "Annals of Hygiene"	Philadelphia, Penn.
Dr. George J. Engelmann	St. Louis, Mo.
William J. Evans, Esq.	New York City.
J. T. Fanning, C. E.	Manchester, N. H.
Dr. John Fee	Kansas City, Mo.
Dr. Thomas H. Fenton	Philadelphia, Penn.
Hon. John C. Ferris	Nashville, Tenn.
C. S. D. Fessenden, Surgeon U. S. M. H. S.	St. Louis, Mo.
Dr. N. Fields	Jeffersonville, Ind.
Prof. W. E. Fischel, St. Louis Medical College	St. Louis, Mo.
Dr. William Freeman	Vevay, Ind.
Dr. Frank R. Fry	St. Louis, Mo.
Dr. Robert M. Funkhausen	St. Louis, Mo.
Dr. John Green	St. Louis, Mo.
Dr. John J. Green, Board of Health	Pittsburgh, Penn.
Dr. E. H. Gregory	St. Louis, Mo.
Dr. Charles H. H. Hall	Washington, D. C.
Dr. Willis Hall	St. Louis, Mo.
Prof. G. Hambach, M. D.	St. Louis, Mo.
Dr. W. A. Hardaway	St. Louis, Mo.
Dr. M. H. Harding	Lawrenceburg, Ind.
Dr. Charles Harrington	Boston, Mass.
Dr. T. A. Harris, President State Board of Health	Parkersburgh, W. Va.
Dr. W. J. Harris	St. Louis, Mo.
Dr. Edward M. Hartwell, Johns Hopkins University	Baltimore, Md.
Dr. J. C. Hearne, Secretary State Board of Health	Hannibal, Mo.
Dr. H. F. Hereford, State Board of Health	Kansas City, Mo.
J. H. Herimann	St. Louis, Mo.
Dr. Cumberland G. Herndon, U. S. N.	Washington, D. C.
E. J. Hodgson, Esq.	St. Paul, Minn.
Dr. J. R. Hoffman	Athens, Ala.
Dr. T. E. Holland	St. Louis, Mo.
Prof. P. O. Hooper	Little Rock, Ark.
Dr. George Howe	Columbia, S. C.
Dr. Henry F. Hoyt, President Board of Health	St. Paul, Minn.
Dr. B. M. Hypes	St. Louis, Mo.
Dr. J. W. Jackson	Kansas City, Mo.
Dr. C. S. Johnson, State Board of Health	Hudson, Wis.
Prof. J. P. Kingsley	St. Louis, Mo.
Dr. Charles Knapp	Evansville, Ind.
Dr. C. Kollock	Cheraw, S. C.
Dr. George N. Krieder, State Board of Health	Springfield, Ill.
Prof. H. Leffman, M. D.	Philadelphia, Penn.
Dr. B. F. Leonard	Baltimore, Md.
Dr. T. B. Lester	Kansas City, Mo.
Prof. George W. Letterman	Allenton, Mo.
Dr. Eugene R. Lewis	Kansas City, Mo.
Capt. Henry Lomb	Rochester, N. Y.
Dr. I. N. Love	St. Louis, Mo.
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Prof. William T. Smith, M. D.	Hanover, N. H.
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Dr. R. A. Vaughan	St. Louis, Mo.
Dr. Edwin Walker	Evansville, Ind.
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Dr. John B. Weever	Mount Vernon, Ind.
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Dr. Charles H. White, U. S. N.	Washington, D. C.
Dr. H. L. Williford, Health Officer	Shelby county, Tenn.
Dr. J. H. Wooden	Greensburgh, Ind.
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CHARLES SPECK, Esq.	St. Louis, Mo.
H. C. TOWNSHEND, Esq.	St. Louis, Mo.
WALTER F. WELLS, Esq.	Winthrop, Mass.

The following named members of the NATIONAL ASSOCIATION OF MASTER PLUMBERS OF THE UNITED STATES made application for membership immediately after adjournment at St. Louis, and are recommended for election by the Executive Committee:

ANDREW YOUNG, *President*	Chicago, Ill.
J. J. WADE, *Secretary*	Chicago, Ill.
A. W. MURRAY	Chicago, Ill.
J. J. HAMBLIN	Chicago, Ill.
Col. GEORGE D. SCOTT	New York City.
JEREMIAH SHEEHAN	St. Louis, Mo.
JAMES ALLISON	Cincinnati, O.
THOMAS HAVEY	Chicago, Ill.
MARTIN MOYLAN	Chicago, Ill.
EDWARD MURPHY	New York City.
W. H. GRAHAM	St. Louis, Mo.
SIMON SHULHAFER	Louisville, Ky.

NOTE. The secretary desires to be informed of any errors that may be discovered in the above list of names, that the corrections may be made in publishing the next full list of members.